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Background Document For First Third Wastes To Support 40 CFR Part 268 Land Disposal Restrictions

Final Rule

First Third Waste Volumes, Characteristics, and Required and Available Treatment Capacity

BACKGROUND DOCUMENT
FOR
FIRST THIRD WASTES TO SUPPORT 40 CFR PART
268 LAND DISPOSAL RESTRICTIONS

FINAL RULE

FIRST THIRD WASTE VOLUMES, CHARACTERISTICS,
AND REQUIRED AND AVAILABLE TREATMENT CAPACITY

U.S. Environmental Protection Agency
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EXECUTIVE SUMMARY

This document supports the final land disposal restriction rule for First Thirds wastes under the Resource Conservation and Recovery Act (RCRA). It includes estimates of the quantities of wastes that will require alternative treatment or recovery prior to land disposal under the treatment standards set by that rule and estimates of the availability of alternative treatment and recovery capacity to accommodate these diverted wastes. It also includes a reassessment of capacity analyses developed for wastes covered by previous rules the solvent wastes and California List Halogenated Organic Compound (HOC) wastes in the light of new data.

As of this rulemaking, all capacity analyses supporting the land disposal restrictions program will be based on data developed from the National Survey of Hazardous Waste Treatment, Storage, Disposal, and Recycling Facilities (the TSDR Survey). The TSDR Survey is a census of all RCRA-permitted and interim status hazardous waste treatment, disposal, and recycling facilities; it also contains a representative sample of hazardous waste storage facilities. The data set developed from this survey provides detailed information on the volume and characteristics of wastes currently sent to land disposal facilities and on both the current and planned capacity of treatment and recovery facilities.

Legal Background

The Hazardous and Solid Waste Amendments (HSWA) to RCRA, enacted November 8, 1984, set basic new priorities for hazardous waste management. Land disposal, which has been the most widely used method for managing hazardous waste, is now the least preferred option. Under HSWA, the Environmental Protection Agency (EPA) must promulgate regulations restricting the land disposal of hazardous wastes according to a strict statutory schedule. As of the effective date of each regulation, land disposal of untreated wastes covered by that regulation is prohibited unless it can be demonstrated that there will be no migration of hazardous constituents from the disposal unit for as long as the waste remains hazardous.

The statutory schedule set by HSWA divided hazardous wastes into three broad categories. The first group, which contained wastes restricted under regulations issued on November 8, 1986, include generic solvent and dioxin wastes. The second group, whose final rule was issued on July 8, 1987, covers a group of wastes originally listed by the State of California and adopted intact within HSWA: the California List wastes comprise 5 classes of wastes: liquid hazardous wastes with a pH of less than 2.0 (acidic wastes); all liquid hazardous wastes containing free cyanides, various metals, and polychlorinated biphenyls (PCBs) exceeding statutory concentration levels; and all wastes (liquid or solid) containing halogenated organic compounds (HOCs) in concentrations greater than or equal to statutory levels. All hazardous wastes (except those covered by the solvents and dioxins rule) fall into the last category, scheduled wastes; HSWA requires EPA to promulgate regulations for these wastes on a timetable that would restrict at least one-third of them by August 8, 1988 (today's rule), at least two-thirds by June 8, 1989, and the rest by May 8, 1990.

Under the Land Disposal Restrictions Program, EPA must set levels or methods of treatment that substantially reduce the toxicity of a waste or the likelihood of migration of hazardous constituents from the waste. Where possible, EPA prefers to define treatment in terms of performance rather than in terms of specific technical methods. HSWA requires, however, that levels specified in the regulations be demonstrated and achievable. Accordingly, EPA's standards are generally based on the performance of the best demonstrated available technology (BDAT), as documented by treatment data collected at well-designed and well-operated systems.

The land disposal restrictions are effective immediately upon promulgation unless the Agency grants a national variance from the statutory date because of a lack of available capacity. For every waste group, EPA considers, on a national basis, both the capacity of available treatment or recovery technologies and the quantity of restricted wastes currently sent to land disposal. If the Agency determines that adequate alternative treatment or recovery capacity is available for a particular waste or waste group, the land disposal restriction goes into effect immediately upon promulgation of the rule. If not, the Agency establishes an alternative effective date based on the earliest date on which adequate treatment or recovery capacity will be available.

Summary of Capacity Analyses for Previous Land Disposal Restrictions

Previous rules under the land disposal restrictions program include the final rules for solvent and dioxin wastes and the California List wastes, and the proposed rule for the First Thirds wastes. Capacity analyses for these waste groups relied on the best data available at the time. Their results are summarized below.

Solvents and Dioxins

The November 8, 1986, rule (51 FR 40572) set treatment standards for F001/F005 spent solvent wastes and F020/023 and F026/F028 dioxin wastes. These standards were expressed as concentration limits in waste extracts. Waste exceeding these limits were banned from land disposal.

The capacity analysis supporting this rule relied primarily on data from the 1981 Regulatory Impact Analysis (RIA) Mail Survey (for volumes analysis) and a telephone verification and clarification of information provided in the 1986 National Screening Survey for information on capacity. Using the physical and chemical characteristics reported for each waste stream, EPA identified one or more technologies that it believed would be used to meet the treatment standards for that waste stream. It concluded the following:

1. Solvents: The capacity analysis indicated shortages of necessary incineration and wastewater treatment capacity. EPA therefore granted a 2 year national capacity variance to CERCLA and RCRA corrective action wastes, small quantity generator wastes, and the solvent containing wastes with less than 1 percent total F005/F005 solvent constituents (40 CFR 268.30).

2. Dioxins: Estimated shortages of incineration capacity led EPA to grant a 2 year national capacity variance to dioxin-containing wastes (51 FR 40617).

The final First Thirds rule reanalyzed these conclusions using information from the TSDR Survey data set.

California List Wastes

Unlike the solvents and dioxins rule, the California List rule is not waste code specific. For HOC wastes, the July 8, 1987, rule (52 FR 25760) established incineration as BDAT. For PCBs, EPA defined BDAT as thermal treatment in accordance with 40 CFR 761.60. The Agency adopted the statutory limits for acidic corrosive wastes, but did not promulgate a treatment standard for those wastes. The final rule did not establish prohibition levels for metal or cyanide wastes; a final determination for these wastes was to be made in a separate rulemaking.

As for the solvents rule, the capacity analysis for the California List relied primarily on the 1981 RIA Mail Survey for information on volumes and on a telephone verification and clarification of information provided in the 1986 National Screening Survey for information on capacity. As before, it assigned estimated volumes of wastes that would be subject to the rule to treatment technologies that would be generally applicable to these wastes. The analysis concluded:

1. Cyanide and metal wastes: Since the rule did not specify a treatment standard for these wastes, land disposal is still allowed after the wastes have been rendered nonliquid. The Agency therefore concluded that adequate capacity for these wastes exists, and did not grant a capacity variance for them.

2. PCB wastes: The analysis projected adequate capacity for these wastes.

3. Acidic corrosive wastes: Since the rule did not specify a treatment standard for these wastes, land disposal is still allowed after the wastes have been rendered nonliquid. The Agency therefore concluded that adequate capacity for these wastes exists, and did not grant a capacity variance for them.

4. HOC wastes: The capacity analysis projected shortages of incineration capacity for HOC wastes. The Agency therefore granted a 2 year national capacity variance for HOC wastes requiring incineration.

Similar to the solvent and dioxin wastes, the final First Thirds rule includes a reanalysis of required and available treatment capacity for California List HOC wastes using information from the TSDR Survey data set.

First Thirds Wastes

The final First Thirds rule contains an analysis of required and available treatment capacity for all First Third wastes based on information from the TSDR Survey.

Methodology

The capacity analysis for final First Thirds rule, and the reanalysis of capacity for wastes granted variances under previous rules, was based primarily on the TSDR Survey. Review of that survey is discussed below, followed by a general summary of the methodology used for the various capacity analyses. Detailed discussions of the capacity methodologies applied to individual wastes can be found in the full text of this report.

Review of of the TSDR Survey

The TSDR Survey was mailed to over 2,625 facilities in August of 1987. The deadline for review and analysis of data in support of the proposed First Thirds rule was April 11, 1988, by which time 2,261 facilities had returned their surveys: All but 115 facilities had returned their surveys by July 22, 1988, which was the deadline for consideration of additional data to support the final rule. A summary of responses that were available for this report is shown in Table 1 below.

Table 1. Summary of Responses on TSDR Survey Supporting the Capacity Analysis for First Thirds Wastes

Management Technique	Facilities Reporting
Land disposal	449
Commercial treatment	371
Other commercial treatment and recovery processes	106
Commercial combustion	49

For those facilities that had not returned their surveys by the July 22 deadline, some data were gathered by phone from these facilities, and, where available, other sources were used for critical items.

The baseline year for the TSDR Survey was 1986. The survey also requested estimated data on planned changes to existing processes and any new processes planned for the years 1987 through 1992; responses were based on plans current when the surveys were filled out.

The general categories of data gathered on treatment and recovery processes are shown in Table 2 below.

Table 2. Categories of Data on Treatment and Recovery Facilities Reported in the TSDR Survey

Category of Data	Description
General categories (including new or planned processes)	Type of process Operating status Commercial status
Key parameters	Feed rates (by physical form) Operating hours Pollution controls
Waste types	Waste codes managed in 1986 Restrictions or specifications for waste managed (commercial facilities only)
Capacity	Maximum capacity (by physical form) Utilization rate for 1986 Planned changes
Residuals	Quantity generated (by physical form, percent hazardous) Further management
Equipment (type of unit)	Tanks Containers Thermal treatment units Land disposal units (e.g., surface impoundments, waste piles)

The TSDR Survey was designed to provide detailed information on the types and quantities of all RCRA hazardous waste managed, by specific land disposal or land placement practice, at all RCRA permitted and interim status facilities. It also provides waste characterization data that, although limited, are adequate for identifying applicable treatment or recovery technologies. These include:

- RCRA waste code (or codes, if more than one is applicable)
- Waste description (physical and chemical form, qualitative information on hazardous constituents)
- Industry description (general information describing the industries that generated each type of waste reported at a particular facility)
- Quantities of wastes that entered land disposal or land placement in 1986
- Residuals information (if a waste was actually a residual from onsite hazardous waste management operations)

General categories of data gathered on land disposal units are shown on Table 3.

Table 3. Categories of Data on Land Disposal and Land Placement Units Reported in the TSDR Survey

Category of Data	Description
General categories	Type of unit Type of process Permit status (interim status or permit) Commercial status Operating status Closure plans
Key parameters	Liner type (plans for upgrading)* Pollution controls
Waste types	Waste types and quantities managed in 1986 Restrictions of specifications for waste managed (commercial facilities only)
Capacity	Design capacity Utilization rate for 1986 Remaining capacity Planned changes
Residuals	Quantities of effluents and dredged solids Further management

* Allows distinguishing minimum technology requirements.

Owners and operators were asked to report on the volume and characteristics of wastes being land disposed at their site and to provide technical information and capacity data on available hazardous waste treatment and recovery technologies. They furnished historical data on calendar year 1986 activities and estimated data on planned activities, including changes in capacity, through 1992. Data from the TSDR Survey was given technical review to ensure completeness, consistency, and accuracy at the facility level. Analysts considered and reviewed facility responses to essentially every question in the survey, including general and detailed schematic diagrams of all onsite hazardous waste management operations, and followed quality assurance and quality control procedures throughout the review and reporting of all data used. Facility followup by phone was often necessary to complete certain parts or questions of the survey and to verify any corrections that were made.

Additional data sources were used only when necessary to fill obvious data gaps in the TSDR Survey. These sources primarily provided supplemental data for facilities that were late in responding to the survey, or for facilities that had provided incomplete responses and either would not or could not assist EPA in completing their responses.

Methodology Used for Capacity Analysis

EPA has assessed the adequacy of current capacity on a waste-stream-by-waste-stream basis, comparing required capacity with available capacity. Linking required and available capacity depended on defining a waste's treatability those chemical and physical parameters that determine its suitability for various treatment or recovery technologies.

Required Capacity

The required capacity (or capacity demand) for a given waste is equal to the volumes of that waste that will be diverted from land disposal and require alternative treatment or recovery by the provisions of the applicable land disposal restriction rule. Capacity demands are therefore strongly dependent on the exact treatment standard defined for each waste, which, as noted above, is in turn dependent on the performance of the appropriate best demonstrated and available technology (BDAT).

Wastes were sorted into groups according to both land disposal practices of concern and treatability. The land disposal practices of concern under HSWA include treatment, storage, and disposal in surface impoundments, treatment or storage in waste piles, land treatment, and disposal in landfills. The analysis included adjustments for the rule that allows treatment in surface impoundments to be conducted only in impoundments meeting minimum technological requirements; wastes treated in min-tech surface impoundments were dropped from further analysis since these wastes are no longer considered as prohibited from land disposal.

Treatability assessments were made on the basis of waste code and physical/chemical form and characteristics. Each treatability group was then assigned to the applicable BDAT technology. For instance, all wastes requiring sludge incineration would be placed in the same treatability group. Combined waste streams (i.e., waste streams described by more than one waste code), and wastes of a unique or complex nature, pose special problems because they often require multiple types of treatment. In these cases, EPA identified treatment trains combinations of technologies in sequence that could treat all components within the treatability group. Finally, some treatment methods create hazardous residuals that in turn require treatment prior to land disposal. In these cases, the Agency estimated the quantities of hazardous residuals generated by treatment and included these in capacity demand estimates.

Available Capacity

Available capacity is the difference between maximum capacity and currently utilized capacity. It is defined initially at the facility level and then aggregated upward to the national level.

In the TSDR Survey, facility-level data were reported on a unit process basis. To obtain estimates of available capacity that could be directly compared with capacity demand, survey data had to be analyzed at the facility level in terms of treatment systems. A treatment system is defined as one or more different processes used together in one or more units to treat or recover waste. Capacity of the treatment system may be limited by the capacity of one or more unit processes within the system.

Capacity Analysis

Estimating the adequacy of capacity at the national level involves comparisons of required and available capacity. The capacity analysis considered all types of capacity separately private facilities, certain limited commercial facilities (i.e., private facilities that accept outside wastes from commercial waste brokers for a fee), and commercial facilities.

Balancing of supply and demand must take into account the commercial status of each treatment system and facility. The available capacity of systems identified as private can only be assigned to wastes sent to land disposal at that site. Wastes diverted from land disposal for which alternative onsite treatment or recovery capacity does not exist becomes part of the aggregate demand for commercial capacity offsite.

The comparative capacity analysis on which the First Thirds rule is based takes into account the sequential and cumulative effects of previous land disposal restrictions, and projected capacity changes (both expansions and contractions) after 1986, the TSDR Survey baseline year. In actually carrying out the capacity analysis, EPA did not follow the chronological sequence of the rules (solvents/dioxins, California list, First Thirds).

Solvent and dioxin wastes were assigned to available capacity first, then First Thirds wastes, then California List wastes, and finally estimated contaminated soils wastes. This was done because the First Thirds wastes are waste-code specific and can therefore be analyzed more accurately than can the generically defined California List wastes. For clarity, however, the results below are shown in the chronological order of the HSWA schedule of rules

Results

All RCRA Wastes

Table 4 below presents estimates of the total volume of RCRA wastes managed through some form of land disposal on an annual basis. These numbers represent the sums of all waste volumes managed by treatment, storage, or disposal in land disposal units. To standardize comparisons, data reported in tons were converted to gallons at a ratio of 240 gallons/ton, based on the density of water. These estimates are based on reported 1986 volumes and do not include wastes managed in surface impoundments that will be replaced by tanks or that will be retrofitted to meet minimum technology requirements by 1988.

Table 4. Estimates of 1986 Land Disposal Wastes Volumes/Basis: TSDR Survey

Land Disposal Volume/Method	Total RCRA/ (million gallons per year)
Storage only	
Waste piles	92
Surface impoundments	126
Treatment	
Waste piles	63
Surface impoundments	1,521
Disposal	
Landfills	600
Land treatment	83
Surface impoundments	218
Total	2,703

These estimates have also been adjusted to eliminate any double-counting of volumes through sequential placing of wastes in multiple units, such as storage followed by disposal.

These land disposal volumes are apportioned among the rules of concern as follows: A total of 113 million gallons per year of wastes falling under the solvent rule are sent to land disposal, as are 34 million gallons of California list HOC wastes (this last figure includes 16 million gallons of HOC wastes that are covered by both the California List and the First Thirds rule; to avoid double counting, these are being included with the First Thirds), and 861 million gallons of First Thirds wastes.

Not all these wastes require commercial capacity evaluations, however. Some wastes are only being stored on site. Others either already meet BDAT requirements for land disposal, or will be treated on site prior to any disposal. Finally, the Agency is not proposing treatment standards for some wastes within the First Third; these wastes will be subject to the soft hammer provisions and may be sent to land disposal until 1990, or until EPA defines a treatment standard, whichever comes first.

Note that BDAT treatment for some wastes results in the generation of hazardous residuals that require treatment, and therefore require allocation to available treatment capacity. In total, 4 million gallons of hazardous residuals will be generated each year by the solvents waste streams and 18 million gallons by the First Thirds wastes.

Solvent Wastes

Using the TSDR Survey data set, EPA estimates that 42 million gallons per year of solvents wastes currently disposed of on land will require alternative treatment or recovery capacity in commercial facilities. Commercial capacity requirements for solvents are shown on Table 5.

Table 5. Commercial Capacity Requirements for Solvent Wastes/Basis: TSDR Survey

Commercial/ Technology	Available Commercial Capacity (million gallons per year)	Required Capacity (million gallons per year)
Combustion		
Liquids	275	1
Sludges/solids	47	38
Stabilization	499	4
Wastewater treatment		
Cyanide oxidation	159	<1
Steam stripping Carbon adsorption Biological treatment Wet air oxidation	66	2

The results of the analysis indicate that adequate capacity exists for the volume of solvent wastes requiring alternative treatment/recovery capacity.

California List HOC Wastes

Using the TSDR Survey data set, EPA estimates that approximately 4 million gallons per year of California List HOC wastes currently sent to land disposal will require alternative treatment or recovery capacity.

HOC wastes that also contain solvent wastes (F001/F005) or First Third wastes for which treatment standards are being promulgated today were included in the analyses for those rules and are therefore not included in the volume of HOC wastes. Commercial capacity requirements are shown on Table 6 below.

Table 6. Commercial Capacity Requirements for California List HOC Wastes/Basis: TSDR Survey

Commercial/ Technology	Available Commercial Capacity (million gallons per year)	Required Capacity (million gallons per year)
Combustion/		
Liquids	274	<1
Sludge/solids	9	2
Wastewater treatment for HOCs		
Steam stripping Carbon adsorption Biological treatment Wet air oxidation	64	7

The Agency had previously granted a 2 year national capacity variance to HOC wastes requiring incineration. Since it has now determined that adequate capacity does exist for the volume of HOC wastes requiring combustion, the Agency is rescinding the capacity variance for HOC wastes requiring combustion.

First Thirds Wastes

Using the TSDR Survey data set, EPA estimates that 431 million gallons per year of First Thirds wastes affected by today's final rule are currently sent to land disposal and will therefore require alternative treatment or recovery capacity. First Third wastes that also contain solvent wastes (F001/F005) were included in the solvent analysis and therefore are not included in the volume of First Third wastes. Commercial capacity requirements are shown on Table 7 below.

Table 7. Commercial Capacity Requirements for First Third Wastes

Commercial/ Technology	Available Commercial Capacity (million gallons per year)	Required Capacity (million gallons per year)
Combustion		
Liquids	274	<1
Sludges/solids	7	6*/160
Stabilization	495	231
Solvent extraction	1	0*/154
Metals recovery		
High temperature metals	34	62
Wastewater treatment		
Chromium reduction	260	40
Carbon adsorption and Chromium reduction	12	1
Sludge treatment	0	4

* 6 million gallons of non K048/K052 wastes require sludge/solids combustion. The amount of K048/K052 sludges/solids requiring combustion, or ssolvent extraction, is 154 million gallons. K061 is assigned to both high temperature metals recovery and to stabilization because stabilization will be the interim BDAT standard for this waste during the 2 year national capacity variance granted for high temperature metals recovery.

This analysis indicates a serious shortage of capacity for sludges/solids combustion, solvent extraction, metals recovery, and sludge treatment. The Agency is therefore granting a 2 year national capacity variance to K048, K049, K050, K051, and K052 wastes requiring sludges/solids combustion or solvent extraction, K061 wastes requiring high temperature metals recovery (although such wastes are subject in the interim to a standard based on stabilization), and K071 wastes requiring sludge treatment.

Table 8 below presents commercial capacity requirements for the First Third wastes affected by today's proposed rule, taking into account the exclusion of volumes of wastes for which the Agency is granting capacity variances.

Table 8. Commercial Capacity Requirements for First Third Wastes Including Allowance for Capacity Variances

Commercial/ Technology	Available Commercial Capacity (million gallons per year)	Required Capacity (million gallons per year)
Combustion		
Liquids	274	<1
Sludges/solids	7	6
Stabilization	495	214
Metals recovery		
High temperature metals	34	0
Wastewater treatment		
Chromium reduction	260	40
Carbon adsorption and chromium reduction	12	0
Sludge treatment	0	0

The results of this adjusted analysis show that adequate capacity does exist for the other First Third wastes covered for which the Agency is promulgating treatment standards.

Contaminated Soils

Because of the unique regulatory and treatability issues associated with contaminated soils, such wastes have been evaluated separately. Using the TSDR data set, EPA estimates that 69 million gallons per year of contaminated soils currently sent to land disposal will require alternative commercial treatment or recovery capacity.

Estimates of available capacity for contaminated soils were determined after first assigning the available national capacity to the non-soil solvent, First Third, and HOC wastes. Commercial capacity requirements for contaminated soils are shown on Table 9 below.

Table 9. Commercial Capacity Requirements for Contaminated Soils

Commercial/ Technology	Available Commercial Capacity (million gallons per year)	Required Capacity (million gallons per year)
Combustion of soils contaminated with:		
Solvents		26
First Third wastes		12
HOC wastes	1	4
		42
Stabilization of soils contaminated with:		
Solvents		10
First Third wastes	264	17
		27

The analysis shows that adequate capacity exists for the volume of soils requiring stabilization. Adequate capacity does not exist, however, for the volume of soils requiring combustion. Thus, the Agency is granting a 2-year variance for soils requiring combustion.

HSWA also affects disposal in salt dome and salt bed formations, underground mines, and caves. Data on this type of disposal are, however, insufficient for the purposes of this rule, and they have not been addressed in this analysis. Underground (deepwell) injection, another form of land disposal, will be covered under a separate rulemaking and therefore is not analyzed here.

1.0 INTRODUCTION

This section contains a brief summary of the legal background on the Land Disposal Restrictions Program, a summary of the results of capacity analyses to support prior restrictions, and an introduction to the capacity analysis for those wastes analyzed for this rule.

1.1 Legal Background

The Hazardous and Solid Waste Amendments (HWSA) to RCRA, enacted on November 8, 1984, require the Agency to promulgate regulations that restrict the land disposal of hazardous wastes. Specifically, the amendments specify dates when particular groups of hazardous wastes are restricted from land disposal unless it has been demonstrated that there will be no migration of hazardous constituents from the disposal unit for as long as the waste remains hazardous.

The amendments also require the Agency to set levels or methods of treatment that substantially reduce the toxicity of the waste or the likelihood of migration of hazardous constituents from the waste. Wastes that meet treatment standards established by EPA are not prohibited and may be land disposed.

In the November 7, 1986, rulemaking (51 FR 40572), EPA promulgated a technology-based approach to establishing treatment standards. These treatment standards are generally based on the performance of the best demonstrated available technology (BDAT) identified for the hazardous constituents in a particular waste. EPA may establish treatment standards based on the performance of the BDAT treatment either as a specific technology or as concentration levels in the waste or treatment residual.

The land disposal restrictions are effective immediately upon promulgation unless the Agency grants a national capacity variance from the statutory date based a lack of adequate alternative capacity. To make this determination, EPA considers, on a national basis, both the capacity of alternative treatment/recovery technologies and the quantity of restricted wastes being land disposed. If adequate capacity is available, the restriction on land disposal goes into effect immediately upon promulgation. If there is a shortfall in national capacity, EPA may establish an alternative effective date based on the earliest date on which adequate capacity that is protective of human health and the environment will be available.

1.2 Summary of Previous Land Disposal Restrictions

Presented in this section is a summary of the results of the capacity analyses to support previous land disposal restrictions. These analyses were performed using the best data available at the time to develop national estimates of the amount of waste land disposed and of available alternative commercial treatment capacity. Analyses of waste volumes affected considered the combination of waste code, physical/chemical form, and type of restricted management practice for determination of the amount of alternative capacity required.

1.2.1 Solvents and Dioxins

The Land Disposal Restrictions Program began with the promulgation of the solvents and dioxins final rule on November 7, 1986 (51 FR 40572). The final rule encompassed F001-F005 spent solvent wastes and F020-F023 and F026-F028 dioxin wastes, and it established treatment standards expressed as concentrations in the waste extract. The rule prohibits land disposal of solvent and dioxin wastes unless the wastes contain less than the specified concentrations of hazardous constituents.

For that final rule, EPA performed an analysis of required and available treatment/recovery capacity. The Agency used the 1981 Regulatory Impact Analysis (RIA) Mail Survey to identify the volume of land-disposed solvent wastes subject to the restrictions. Although EPA did not establish required treatment technologies for these wastes, the Agency used the physical and chemical characteristics that were reported for each waste stream to identify the technology or technologies that EPA assumed would be used to meet the treatment standards. The waste volumes were distributed among the applicable technologies as shown below:

Waste stream	Applicable treatment and recovery technologies
Solvent-water mixtures	Wastewater treatment
Organic liquids	Distillation Fuel substitution Incineration
Organic sludges	Fuel substitution Incineration
Inorganic sludges or solids	Incineration

After identifying the required alternative capacity for solvent wastes, the Agency analyzed the available commercial capacity for these technologies.

Analysis of available capacity (supply) and required capacity (demand) showed shortfalls in available capacity for wastewater treatment and incineration. Consequently, the Agency granted a 2-year national capacity variance to CERCLA and RCRA corrective action wastes; small quantity generator (SQG) wastes; and all wastes containing less than 1 percent total F001-F005 solvent constituents, i.e., solvent-water mixtures, solvent-containing sludges, and solvent-contaminated soil (40 CFR 268.30 and Ref. 1).

EPA determined the volume of dioxin-containing waste generated annually and affected by the restrictions. Incineration capacity for these dioxin wastes was determined to be inadequate; therefore a 2-year national capacity variance was granted (51 FR 40617).

Today's final rule includes a reanalysis of available and required treatment capacity for solvent wastes using data from EPA's new data set based on the results of the National Survey of Hazardous Waste Treatment, Storage, Disposal, and Recycling Facilities (the TSDR Survey). This data set is described in more detail in Sections 2 and 3.

1.2.2 California List

Unlike the solvents and dioxins rule, the California List rule is not waste code specific. The California List includes all liquid hazardous waste with a pH of ≤2.0 (i.e., acidic corrosive waste); all liquid hazardous waste containing free cyanide, metals, or polychlorinated biphenyls (PCBs) in concentrations greater than or equal to those specified; and all hazardous wastes (liquid or solid) containing halogenated organic compounds (HOCs) in amounts greater than or equal to the statutory levels.

The California List final rule was promulgated on July 8, 1987 (52 FR 25760). The Agency established BDAT as incineration in accordance with 40 CFR 264 Subpart O or Part 265 Subpart O for HOC wastes (except HOC wastewaters) and thermal treatment in accordance with 40 CFR 761.60 or 761.70 for PCB wastes. EPA codified the statutory prohibition level for acidic corrosive wastes (those with a pH $\leq$2.0) but did not promulgate a treatment standard for these wastes. The final rule did not establish prohibition levels for metal or cyanide wastes; a final determination for these wastes was to be made in a separate rulemaking.

The Agency used data from the 1981 RIA Mail Survey (Ref. 2) to determine the maximum potential volume of land-disposed waste subject to the California List restrictions. To determine the required alternative treatment capacity for these waste volumes, EPA identified those technologies that it believed would generally be used to treat California List wastes. The Agency then determined the available alternative treatment capacity for these wastes.

A comparison of required and available treatment capacity for the California List wastes for which BDAT has been established showed that incineration capacity for HOC wastes was inadequate. Consequently, the

Agency granted a 2-year national capacity variance to HOC wastes requiring incineration. On the other hand, the Agency determined that adequate capacity for PCB wastes exists, and thus did not grant a variance to these wastes. EPA believes that acidic corrosive, cyanide, and metal wastes can be treated to below the California List statutory levels by tank treatment methods including neutralization, cyanide oxidation, chromium reduction, and chemical precipitation. Since EPA did not establish treatment standards for these wastes, however, they may still be land disposed after being rendered nonliquid. Consequently, the Agency believes that adequate capacity for these wastes exists and did not grant a capacity variance for them (Ref. 3).

Today's final rule includes a reanalysis of required and available treatment capacity for California List HOC wastes based on the TSDR Survey data.

1.2.3 First Third Wastes Proposed Rules

The Agency proposed its approach to regulating the land disposal of the so-called "First Third" wastes in two parts, the first on April 8, 1988 (53 FR 11742), the second on May 17, 1988 (52 FR 17578). These used different sources of data to estimate capacity needs and requirements.

The April 8 rule relied on the 1981 RIA Mail Survey for estimates of waste volumes and on a telephone verification and clarification of information provided in the 1986 National Screening Survey and various other sources for information on capacity (Ref. 4). All conclusions and proposed actions based on this analysis were reevaluated for the May 17 notice using data developed through the TSDR Survey (Ref. 5). The revised conclusions and proposals were as follows:

- For solvent wastes, the Agency estimated that required alternative capacity for managing these wastes was adequate.
- For the California List HOC wastes that are not also First Third wastes that required alternative capacity was adequate.
- For the First Third wastes for which treatment standards had been proposed on April 8 or May 17, EPA found that capacity was adequate except the following, for which 2-year national capacity variances were proposed:
  - K048, K049, K050, K051, and K052 wastes requiring solids/sludges combustion
  - K061 wastes requiring high temperature metals recovery
  - K106 wastes requiring mercury retorting
- For contaminated soils, the Agency estimated that approximately 48 million gallons will require combustion or stabilization. Although stabilization capacity was found to be adequate, combustion capacity was not. The Agency, therefore, proposed a 2-year national capacity variance to soils requiring combustion.

1.3 Introduction to Today's Final Rule

Today's final rule includes a reanalysis of some of the issues covered in the May 17 proposal. First, some additional late facility data has been added to the TSDR data set, modifying certain required and available capacity estimates. Second, some of the proposed treatment standards have been modified, based on changes in the proposed best demonstrated and available technologies (BDAT).

Today, EPA is promulgating treatment standards for only some of the First Third wastes. These are referred to in this document as "First Third promulgated wastes," and are listed in Table 2.3.1. Those wastes for which the Agency is not finalizing a treatment standard are covered by the so-called "soft hammer" provision of the statute. The soft hammer allows these wastes, including their associated treatment residuals, to be disposed of in a minimum technology surface impoundment or landfill if it can be certified that such disposal is the only practical alternative to treatment currently available.

Several commenters on the proposed rule felt the Agency has underestimated the amount of wastes requiring capacity by not including landfill leachate wastes. These types of wastes when described by a code for which a standard is being finalized have been included in the analysis of required capacity. The Agency understands, however, that often facilities cannot easily assign specific codes to these wastes. Consequently, specific codes were developed for the TSDR Survey in order for facilities to report the "derived from" wastes.

In order to evaluate the potential impact of these wastes, the Agency performed an analysis of leachate generation and mangement at 23 facilities with commercial landfills (Ref. 6). These facilities reported 78.1 million gallons of leachage generated annually. Of this volume, only 312,000 million gallons was land disposed and therefore directly affected by this Final Rule. In 1988, the Agency estimates that 58.5 million gallons will be managed in onsite wastewater treatment systems prior to discharge to a POTW or under a NPDES permit. The remaining 19.6 million gallons will require offsite treatment. Of the

19.6 million gallons, 16.7 million gallons were previously treated offsite as hazardous waste and therefore will not require additional capacity because it has already been included in the utilized capacity for the receiving facilities. The remaining 2.9 million gallons is estimated to require additional offsite capacity in 1988. The necessary required treatment processes are assumed to include carbon adsorption, chromium reduction, chemical precipitation, and/or biological treatment. Although this analysis only included 23 commercial landfills, the Agency believes this pattern can be extrapolated to all leachate generation. Therefore, the Agency does not believe that large demands will not be placed on available capacity due to leachate wastes. The complete response to this and all other "capacity" related public comments can be found in the docket for today's Final rule (Ref. 7).

This document presents the results of the capacity analysis completed for today's final rule, and includes an analysis for solvent, First Third promulgated wastes, and non-First Third promulgated California List HOC wastes. Detailed waste code-by-waste code analyses for all First Third promulgated wastes are presented in Section 2.2.5.

Table 1-1 First Third Promulgated Wastes[a]

Waste code	Description
F006[b]	Wastewater treatment sludges from certain electroplating operations
K001	Bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol
K004[b]	Wastewater treatment sludge from the production of zinc yellow pigments
K008[b]	Oven residue from the production of chrome oxide green pigments
K015	Still bottoms from the distillation of benzyl chloride
K016, K018, K019, K020	Heavy ends or distillation residues from production of certain halogenated organics
K021[b]	Aqueous spent antimony catalyst waste from fluoromethanes production
K022[b]	Distillation bottom tars from the production of phenol/acetone from cumene
K024	Distillation bottoms from the production of phthalic anhydride from naphthalene
K030	Column bottoms or heavy ends from the combined production of trichloroethylene and perchloroethylene
K036[b]	Still bottoms from toluene reclamation distillation in the production of disulfoton
K037	Wastewater treatment sludges from the production of disulfoton
K044	Wastewater treatment sludges from the manufacturing and processing of explosives
K045	Spent carbon from the treatment of wastewater containing explosives
K046[b]	Wastewater treatment sludges from the manufacturing, formulation, and loading of lead-based initiating compounds
K047	Pink/red water from TNT operations
K048-K052	Various wastes from the petroleum refining industry
K060[b]	Ammonia still lime sludge from coking operations

Table 1-1 (continued)

Waste code	Description
K061[b]	Emission control dust/sludge from the primary production of steel in electric furnaces
K062	Spent pickle liquor from steel finishing operations of plants that produce iron or steel
K069[b]	Emission control dust/sludge from secondary lead smelting
K071	Brine purification muds from the mercury cell process in chlorine production, where separately prepurified brine is not used
K083	Distillation bottoms from aniline production
K086	Solvent washes from cleaning tubs and equipment used in the formulation of ink from pigments, driers, soaps, and stabilizers containing chromium and lead
K087	Decanter tank tar sludge from coking operations
K099	Untreated wastewater from the production of 2,4-D
K101	Distillation tar residues from the distillation of aniline-based compounds in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds
K102	Residue from the use of activated carbon for decolorization in the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds
K103	Process residues from aniline extraction from the production of aniline
K104	Combined wastewater streams generated from nitrobenzene/aniline production

a The "First Third promulgated " wastes are those wastes for which a treatment standard is being finalized today

b Only the nonwastewater form of this waste is included as a "First Third promulgated" waste, wastewaters from this waste are subject to the soft hammer requirements.

2.0 OVERVIEW

This section of the background document presents general discussions of the source(s) of data and methodology used for the capacity analyses in support of this final rule. Also presented are the results of the analyses of waste volumes affected by the land disposal restrictions, for alternative capacity, and available capacity.

2.1 General Methodology

2.1.1 Data Set Development

(1) National Survey of Hazardous Waste Treatment, Storage, Disposal, and Recycling Facilities.

(a) Background. To improve the quality of data used for capacity analyses of hazardous waste volumes and management practices in support of the land disposal restrictions, EPA has conducted the National Survey of Hazardous Waste Treatment, Storage, Disposal, and Recycling Facilities (the TSDR Survey). The TSDR Survey was designed as a census of permitted or interim status treatment, recycling, and disposal facilities, with no weighting factors for statistical analyses to project national estimates. The survey results therefore provide a comprehensive source of waste volumes and treatment, recovery, and disposal capacity data. Only TSDR Survey data available as of July 22, 1988, could be used to support the capacity analyses for this final rule. There was extensive technical review and detailed analysis of the facility responses. Certain facility responses and derived data elements from the facility level analysis were incorporated into a specialized PC-based data set (a series of data systems) developed on land disposal facilities and commercial treatment and recovery facilities.

(b) Schedule and Status. The TSDR Survey was originally mailed to over 2,400 facilities in August 1987. Facilities were allowed 60 days to complete and return the surveys. Many facilities requested and were granted extensions of 30 days. Since August 1987, an additional 225 facilities that either were initially overlooked or are new have been identified and sent the TSDR Survey. Over 2,500 facilities had returned their surveys as of July 22, 1988, the deadline for review and analysis of data for support of this final rule.

A total of 449 facilities reported onsite land disposal/land placement of 63 billion gallons of RCRA hazardous wastes during 1986, the baseline year for the survey. Over 99 percent of the data (by land disposal volume) were reviewed and included in the data set used to support this final rule.

Twenty facilities with land disposal have not returned their surveys to date. However, 15 of these late facilities provided limited information when contacted by phone. In total, these 15 facilities account for 797 million gallons of land disposed waste (excluding underground injection volumes), approximately less than 2 percent of the total reported volume. This results in a 2 percent error factor in the analysis. The Agency is assuming that the wastes at these late facilities will reflect patterns similar to those of the wastes reported; therefore, no problems are anticipated as a result of not having all the data available for this analysis.

A total of 371 facilities with commercial treatment/recovery technologies have completed and returned surveys, accounting for a maximum of 22 billion gallons per year of commercial hazardous waste alternative capacity in 1986. Some of these facilities also reported land disposal onsite and are included in the 433 facilities noted above. However, the analysis was limited to only those technologies considered as the Best Demonstrated Available Technology (BDAT) for, or judged to be applicable, to the wastes covered by this proposal--solvents, California List halogenated organic compounds (HOCs), and First Third wastes, including contaminated soils.

One hundred six facilities reported having commercial processes other than combustion, mostly wastewater treatment capacity, that may be applicable as alternative treatment/recovery of the land disposed wastes of concern for this analysis, accounting for a maximum capacity of 2.5 billion gallons of commercial noncombustion treatment/recovery capacity in 1988.

Forty-nine facilities reported commercial combustion processes (incineration or reuse as fuel in industrial kilns) that may be applicable for burning hazardous waste currently land disposed, accounting for a maximum capacity of 486 million gallons of commercial combustion capacity in 1988.

A total of 54 commercial treatment/recovery facilities have not returned their surveys to date. To fill known data gaps on these late facilities, limited phone contact was attempted to gather critical capacity information; where available, other data sources were also used.

Of the various types of "reuse of fuel" units, only industrial kilns, not industrial boilers or other furnaces, were considered in the analysis of commercial combustion capacity. However, the analysis shows that available capacity at industrial kilns exceeds capacity requirements for the type of wastes commonly burned in these units (organic liquids).

(c) Technology Capacity Information. The TSDR Survey was designed to provide comprehensive information on all current and planned hazardous waste treatment, recycling, and disposal processes at all RCRA permitted and interim status facilities, including information on exempt processes at these facilities (e.g., recycling, wastewater treatment).* The baseline year for the survey was 1986. Information on planned changes to existing processes, including closures, and any new processes planned prior to 1992 was requested.

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* Exceptions to this include totally enclosed treatment facilities (TETFs) and closed loop recycling (CLR), which were not required to be reported. Also, no information was gathered at facilities with only exempt processes.

An overview of the information on treatment and recycling processes, including those taking place in land disposal units (i.e., land placement), is provided below:

• General categories (including new or planned processes)	- Type of process - Operating status - Commercial status - Permit status (exempt, interim status, final)
• Key parameters	- Feed rates (by physical form) - Operating hours - Pollution controls
• Waste types	- Waste codes managed in 1986 - Restrictions or specifications for waste managed (for commercial facilities only)
• Capacity	- Maximum capacity (by physical form) - Utilization rate for 1986 - Planned changes
• Residuals	- Quantity generated (by physical form, percent hazardous) - Further management
• Equipment (type of unit)	- Tanks - Containers - Thermal treatment units - Land disposal units (i.e., surface impoundments, waste piles)

For more detail, refer to the complete set of questionnaires and instructions in the public docket for this final rule (Ref. 8).

(d) Waste Volumes Land Disposed. The TSDR Survey was designed to provide detailed information on the types and quantities of all RCRA hazardous waste managed, by specific land disposal/land placement practices, at all RCRA permitted and interim status facilities. The survey provides limited but adequate characterization data (refer to

Section 3.1.2) to assess the treatability potential of the wastes and to identify applicable alternative treatment/recovery technologies, including:

- RCRA waste code (or codes, if more than one is applicable);
- Waste description (physical/chemical form and qualitative information on hazardous constituents);
- Industry description (general description describing the industries that generated each type of waste at a facility);
- Quantity that entered land disposal/placement in 1986; and
- Residual information (whether this waste was actually a residual from onsite hazardous waste management operations).

The TSDR Survey also provides valuable information on the individual units in which land disposal/placement is occurring, including plans for closures and upgrading/retrofitting to meet the minimum technology requirements. Through review of the questionnaire responses and the facility schematics, it is possible to track individual waste streams managed in more than one type of land disposal unit or managed by more than one process (treatment, storage, or disposal) in surface impoundments and waste piles, to avoid double-counting of waste volumes. An overview of this information is provided below:

- General categories
  - Type of process
  - Permit status (interim status, final)
  - Commercial status
  - Operating status
  - Closure plans
- Key parameters
  - Liner type (plans for upgrading)
  - Pollution controls

• Waste types	- Waste types and quantities managed in 1986 - Restrictions or specifications for waste managed (for commercial facilities only)
• Capacity	- Design capacity - Utilization rate for 1986 - Remaining capacity - Planned changes
• Residuals	- Quantities of effluents and dredged solids - Further management

For more details, refer to the complete set of questionnaires in the public docket for this final rule.

(e) Overview of Data Handling, Technical Review, and Quality Assurance. Extensive technical review of TSDR Survey data was required to ensure completeness, consistency, and accuracy on a per-facility basis. To achieve this goal, the review process was designed to promote the consistent and efficient identification and resolution of any errors, inconsistencies, and omissions, including any required facility followup. The review procedures were comprehensive and required the consideration and analysis of the facility responses to essentially every question in the survey (if applicable to that facility), as well as the review and further development of general and detailed schematics of all onsite hazardous waste management operations. The detailed review procedures are presented in the <u>Guidelines for Technical Review of TSDR Surveys</u> (Ref. 9), available in the public docket for this final rule.

All surveys from TSDR facilities with onsite land disposal/placement (whether private or commercial) or commercial treatment/recovery operations were considered critical for support of the land disposal restrictions. Therefore, they were categorized as "priority" surveys and were slated to undergo technical review and analysis immediately.

After a survey was determined to be priority, it was distributed to the review teams. Members of the review teams conducted the technical review. Following review, if the responses in a survey indicated that the facility had onsite land disposal/placement, the required PC data sheets were completed immediately and the survey package underwent a preliminary quality control (QC) review by the team leaders. If no land disposal/placement operations were indicated, the review of commercial treatment/recovery operations proceeded, and upon completion, the survey package went to the team leaders for preliminary QC. As part of preliminary QC, the team leader then worked with the reviewer to correct or resolve any problems identified during the survey review (see Ref. 9 for details on the survey screening, distribution, and review procedures).

Treatability assessments of each land disposed waste stream were then conducted (described in Section 3.1.2), and onsite alternative treatment/recovery technologies were screened to determine potential applicability to land disposed/placed wastes. If any technologies were judged to be applicable, a capacity analysis was completed for those technologies (described in Section 3.2).

The last step in the review process consisted of complete or final QC. Approximately 25 percent of the surveys underwent complete QC (see Ref. 10 for detailed information on QC procedures). After QC, the technical review/analysis was considered to be complete.

(2) Other data sources. The TSDR Survey was used as the primary comprehensive source of data on volumes and characteristics of wastes land disposed and required and available treatment/recovery capacity to support the land disposal restrictions under this final rule. Additional data sources were used only when necessary to fill obvious data gaps with regard to the TSDR Survey. These sources were primarily used to provide supplemental data for facilities that were late in responding to the survey or for facilities that had provided incomplete responses and either would not or could not assist in completing the responses.

In a very limited number of cases, commercial facilities that accepted large quantities of a variety of wastes for land disposal claimed that they were unable (or unwilling because of the excessive effort required) to provide detailed waste code, waste description, and quantity information for each land disposed waste stream. To fill such data gaps in the survey, it was necessary to attempt to gather these data from other sources. In most cases, facility contacts provided adequate information; however, for one facility information on hazardous wastes managed was obtained from the 1985 Biennial Reporting Data System, maintained by EPA.

Identifying alternative treatment/recovery technologies (ATRs) applicable to the hazardous waste of concern required coordination with the BDAT (Best Demonstrated Available Technology) Program of EPA/OSW's Waste Treatment Branch. The ATRs used in the analysis of capacity for this final rule include those specific technologies employed by the BDAT Program to establish treatment standards for wastes restricted from land disposal and, in a limited number of cases, other potentially applicable ATRs (or combinations of these technologies, i.e., treatment trains) judged to be capable of meeting the treatment standards for certain wastes with unique characteristics for which the BDAT technology was not directly applicable (or applicable without pretreatment). In such cases (for unique treatability groups), various sources of published literature were used (as described in Section 3.1.2), and engineering judgment were used when necessary. Except for these few unique waste streams, the BDAT Program provided the information on ATRs used to assess their applicability to the wastes of concern and their ability to meet the treatment standards.

2.1.2 Capacity Analysis Methodology

The Agency is responsible for determining whether sufficient alternative capacity is available to meet the demand resulting from the land disposal restrictions. If the Agency determines that capacity is insufficient, it must then project the earliest date at which adequate capacity will be available.

To assess current capacity requirements, an analysis comparing required capacity with available capacity was performed. The comparison was performed on a waste stream-by-waste stream basis, by assessing waste treatability and then using treatability as the link between the volumes of land-disposed wastes requiring alternative capacity and the appropriate available treatment/recovery capacity. (Refer to Section 3.1.2 for a more detailed discussion of treatability analysis.)

(1) Required capacity. The required capacity, or capacity demand, consists of those volumes of wastes currently land disposed that will require alternative treatment when they are restricted from land disposal. The waste streams, along with their volumes, were identified and aggregated by similar treatability and by management practice. The management practices of concern are those practices classified as land disposal under HSWA, which include treatment, storage, or disposal in a surface impoundment; treatment or storage in a waste pile; land treatment; and disposal in a landfill. Salt dome formations, salt bed formations, and underground mines and caves are additional methods of land disposal that are affected by this rulemaking. Currently, there is insufficient information to document the volumes of First Third wastes disposed of by these last three methods; therefore, they are not addressed in the analysis of volumes and required alternative treatment capacity. Underground (deep well) injection, another form of land disposal, will be covered under a separate rulemaking; thus, the volume of underground injected wastes has not been included in this document.

The volumes of waste reported in the TSDR Survey as land disposed in 1986 that require alternative treatment/recovery capacity were adjusted to reflect the rule that allows treatment in surface impoundments to be conducted only in impoundments meeting minimum technological requirements. Volumes of waste that were reported as continuing to be treated in non-minimum technology surface impoundments were considered to require alternative treatment capacity, while those undergoing treatment in impoundments meeting the requirements by 1988 or in impoundments being replaced by tank systems by 1988 were dropped from further analysis. The waste volumes requiring alternative capacity were identified by RCRA waste code(s) and by their land disposal ban regulatory status (i.e., solvents and dioxins, California List, or First Thirds). A detailed discussion of this methodology is presented in Section 3.1.1.

To determine the type of treatment capacity required by the affected wastes, a treatability analysis was performed on each waste stream. Using the waste code, the physical/chemical form data, and the identified BDAT technology, wastes were placed into treatability groups. For example, all wastes requiring sludge incineration would be placed in the same treatability group. The physical/chemical form data were provided by the facility using qualitative technical criteria, not regulatory definitions. For example, liquids wastes were identified as "highly fluid" rather than as "wastes failing the Paint Filter Liquids Test."

Waste groups (i.e., waste streams described by more than one waste code) present special treatability concerns because they are often contaminated with wastes requiring different treatment (e.g., organics and metals). To treat these wastes, a treatment train must be developed that can treat all waste types in the group. A more detailed description of the treatability analysis methodology, including treatment train development, is presented in section 3.1.2.

A number of the treatment technologies to which wastes have been assigned create treatment residuals that will require further treatment prior to land disposal (e.g., stabilization of incinerator ash). In these cases, the Agency has estimated the amount of residuals that would be generated by treatment of the original volume of waste requiring treatment and has included these residuals in the volumes requiring treatment capacity. A more detailed description of the determination of residual volumes is presented in section 3.1.2(4).

BDAT for a number of wastes includes treatment of incinerator scrubber water. Based on TSDR Survey responses, the RCRA permitted incinerators have adequate air pollution control devices (APCDs) (including scrubber water treatment at those facilities with wet scrubbers), and therefore no additional analysis of the volume of scrubber water was made.

(2) Available capacity. The analysis of available capacity, or capacity supply, for treatment/recovery systems began at the facility level. TSDR Survey capacity data were reported on a unit process basis. To obtain estimates of available capacity that could be compared with capacity requirements of affected wastes, a systems analysis approach was taken. For this analysis, a system is defined as one or more different processes used together in one or more different units to treat or recover hazardous waste. The capacity of the treatment/recovery system may be limited by the capacity of one or more of the unit processes within the system. The available capacity of the system is determined by subtracting the utilized capacity of the system from the maximum capacity of the system. A detailed discussion of system capacity determination may be found in Section 3.2.2.

Comparing required capacity with available capacity begins at the facility level and moves to the national level as dictated by the available capacity and commercial status of applicable treatment/recovery systems. The available capacity of systems identified as private is considered only when judged to be applicable to wastes reported as being land disposed at that facility. The remaining volumes of waste still requiring treatment capacity are added to determine the national demand for commercial capacity of each alternative technology.

By comparing the required capacity with the available capacity, the Agency can identify capacity shortfalls and make determinations concerning variances. The comparative capacity analysis accounts for the sequential and cumulative effects of previous land disposal restrictions and for projected capacity changes after 1986 (the baseline year). Solvents and dioxin wastes were assigned to available capacity first, followed by California List HOCs (other than those that are also First Third promulgated wastes), First Third promulgated wastes, and finally soils. In addition, available capacity was first assigned to all affected wastes land disposed in "surface" units (i.e., waste piles, surface impoundments, landfills, and land treatment, but not underground injection wells), and then to contaminated soils. The remaining capacity will then be assigned to wastes injected underground, which will be considered in another rule. The Agency believes that land disposal in surface units may represent a greater threat to human health and the environment than does the underground injection of wastes. Furthermore, contaminated soils are generally from cleanup or corrective action operations, which present an obvious threat.

2.2 Results

2.2.1 All RCRA Wastes

Table 2.2.1 presents estimates of the volumes of RCRA wastes land disposed annually. These volumes were compiled by adding all waste stream volumes managed by treatment, storage, or disposal in land disposal units. Separate waste volumes are shown for storage and treatment in waste piles; treatment, storage, and disposal in surface impoundments; and disposal in landfills and land treatment units. The baseline data for determining the volumes in Table 2-1 were the 1986

Table 2-1 Overview of All RCRA Hazardous Waste

	Land-disposed volume[a] (million gallons/year)
Storage only	
- Waste piles	92
- Surface impoundments	126
Treatment	
- Waste piles	63
- Surface impoundments	1,521
Disposal	
- Landfills	600
- Land treatment	83
- Surface impoundments	218
Total	2,703

[a] Baseline was TSDR Survey data for 1986 (facility responses as of July 22, 1988), adjusted for volumes of waste managed in surface impoundments that will be replaced by tanks or treatment impoundments retrofit to meet minimum technology requirements.

data from responses to the TSDR Survey. Data reported in tons were converted to gallons (using the conversion factor of 240 gallons/ton, based on the density of water), to allow comparisons to available capacity in a standard unit. These reported 1986 volumes were adjusted by subtracting the volumes of waste managed in treatment surface impoundments that will undergo closure and be replaced by tanks or that will be retrofit to meet minimum technology requirements by 1988.

To avoid double-counting of wastes that underwent more than one management operation in the same type of unit (e.g., storage and treatment in a waste pile), the following procedures were used. In tabulating volumes of waste managed in surface impoundments and waste piles, any wastes that underwent treatment in an impoundment or waste pile were reported in the "treatment" volume. Wastes stored in a surface impoundment or waste pile that never underwent treatment in the impoundment or waste pile were reported in the "storage only" volumes. In tabulating surface impoundment volumes, wastes that were disposed of in surface impoundments but not also treated in the impoundment were included among "disposal" surface impoundment volumes.

Not represented in the estimates presented in Table 2-1 are volumes of land-disposed waste from facilities that did not return their TSDR Surveys before July 22, 1988. A telephone survey was conducted for these late facilities, with those facilities that responded reporting approximately 797 million gallons of land-disposed waste in 1986. This represents less than 2 percent of the reported 1986 volumes of land-disposed hazardous waste. Sufficient data were not available to determine specific management practices and RCRA waste codes associated with these volumes.

2.2.2 Solvents

Table 2-2 presents estimates of the volume of solvents land disposed annually, by management practice and by type of land disposal unit. The same procedures described for the analysis of all RCRA wastes were used for estimating solvent volumes. In addition, as a worst-case condition, the entire volume of any waste stream, for both single waste streams and waste groups (waste described by more than one waste code), was considered if the waste stream contained any solvent wastes.

The volume of land-disposed solvent wastes requiring alternative commercial treatment capacity, however, will be somewhat less. As discussed in Section 3, the Agency has assumed that the 13 million gallons of solvent wastes that were only stored in impoundments or waste piles do not require alternative treatment capacity (although they may require alternative storage capacity) because they are treated or disposed elsewhere. Furthermore, the facility-level waste treatability and technology capacity analyses conducted on solvent wastes being land disposed determined that 34 million gallons of these wastes either had already been treated using the BDAT technology or could be treated onsite, and therefore were not included in the volumes requiring

Table 2-2 Overview of Solvents

	Land-disposed volume[a] (million gallons/year)
Storage only	
- Waste piles	2
- Surface impoundments	11
Treatment	
- Waste piles	3
- Surface impoundments	<1
Disposal	
- Landfills	71
- Land treatment	<1
- Surface impoundments	26
Total	113

[a] Baseline was TSDR Survey data for 1986 (facility responses as of July 22, 1988), adjusted for volumes of waste managed in surface impoundments that will be replaced by tanks or treatment impoundments retrofit to meet minimum technology requirements.

alternative commercial treatment capacity. Based on this, the Agency estimates that 66 million gallons of solvent wastes will require alternative treatment capacity on a commercial basis. This volume includes 26 million gallons of soil, which are discussed in a separate section of this document; therefore, it is estimated that only 41 million gallons of nonsoil solvent wastes will require alternative commercial treatment capacity. Finally, the Agency estimates that treatment of this 41 million gallons will generate 4 million gallons of waste residuals that will also require additional alternative treatment capacity.

Table 2-3 presents the estimates of available national commercial capacity for the alternative technologies that are applicable to solvent wastes. Also presented are the estimates of annual land-disposed waste volumes that require alternative commercial capacity (not including contaminated soils or wastes injected underground. As evident from the table, the Agency has determined that based on the new data available from results of the TSDR Survey, there is adequate capacity for all of the solvent wastes that will require alternative capacity.

The Agency believes that the capacity analysis previously conducted for these wastes was accurate at the time of promulgation, and therefore the variances granted at that time were justified (Ref. 1). However, principally because the data used for today's analysis have been adjusted for treatment impoundments that are being replaced by tanks or retrofit, the Agency believes that adequate capacity does now exist for solvent

Table 2-3 Solvent Capacity Analysis

Technology	Available capacity (million gal/yr)	Required capacity (million gal/yr)
Combustion		
- Liquids	275	1
- Sludges/solids	47	38
Stabilization of incinerator ash	499	4
Wastewater treatment		
- Cyanide oxidation, chemical precipitation, and settling/filtration	159	<1
- Steam stripping, carbon adsorption, biological treatment, or wet air oxidation	66	2

wastes. Also, there were significant increases in available commercial incineration capacity since promulgation of the land disposal restrictions rules for solvents.

2.2.3 Nonsolvent RCRA Wastes Containing Halogenated Organic Compounds

Tables 2-4 through 2-6 present estimates of annual land-disposed volumes for nonsolvent RCRA wastes that are potential California List wastes containing HOCs at concentrations of 1,000 mg/kg or greater. Separate tables are presented for total HOC wastes, HOC wastes that are also First Third promulgated wastes, and all other HOC wastes. The same procedures used for tabulating all RCRA wastes apply to HOC volumes. However, the total volume for each management practice in Tables 2-4 through 2-6 represents the sum of all single HOC waste streams (in that table's regulatory group) and all waste groups containing at least one potential HOC and a waste in that table's regulatory group but containing no solvents.

The volume of land-disposed HOC wastes requiring alternative commercial treatment capacity will be somewhat less. The facility-level treatability and capacity analyses conducted on the HOC wastes being land disposed determined that 3 million gallons of these wastes could be treated onsite and, therefore, were not included in the volume requiring alternative commercial treatment capacity. Based on this, the Agency estimates that 15 million gallons of HOC wastes will require alternative treatment capacity on a commercial basis. This volume includes 6 million

Table 2-4 Overview of Potential California List Wastes Containing Halogenated Organic Compounds

	Land-disposed volume[a] (million gallons/year)
Storage only	
- Waste piles	1
- Surface impoundments	<1
Treatment	
- Waste piles	7
- Surface impoundments	6
Disposal	
- Landfills	20
- Land treatment	<1
- Surface impoundments	<1
Total	34

[a] Baseline was TSDR Survey data for 1986 (facility responses as of July 22, 1988), adjusted for volumes of waste managed in surface impoundments that will be replaced by tanks or treatment impoundments retrofit to meet minimum technology requirements

Table 2-5 Overview of Promulgated First Third Wastes Containing Halogenated Organic Compounds

	Land-disposed volume[a] (million gallons/year)
Storage only	
- Waste piles	1
- Surface impoundments	<1
Treatment	
- Waste piles	7
- Surface impoundments	<1
Disposal	
- Landfills	8
- Land treatment	<1
- Surface impoundments	<1
Total	16

[a] Baseline was TSDR Survey data for 1986 (facility responses as of July 22, 1988), adjusted for volumes of waste managed in surface impoundments that will be replaced by tanks or treatment impoundments retrofit to meet minimum technology requirements.

Table 2-6 Overview of All Other Wastes Containing Halogenated Organic Compounds

	Land-disposed volume[a] (million gallons/year)
Storage only	
- Waste piles	<1
- Surface impoundments	<1
Treatment	
- Waste piles	<1
- Surface impoundments	6
Disposal	
- Landfills	12
- Land treatment	<1
- Surface impoundments	<1
Total	18

[a] Baseline was TSDR Survey data for 1986 (facility responses as of July 22, 1988), adjusted for volumes of waste managed in surface impoundments that will be replaced by tanks or treatment standards retrofit to meet minimum technology requirements.

gallons of soil, which are discussed in a separate section of this document (2 million gallons of HOC soils were assigned to onsite treatment); therefore, it is estimated that only 9 million gallons of nonsoil HOC wastes will require alternative commercial treatment capacity.

Table 2-7 presents the results of the capacity analysis for HOC-containing wastes (not including underground injection waste volumes). Similarly, to eliminate double-counting, this table does not include wastes that contain First Third promulgated wastes or solvents.

Based on the data from the TSDR Survey, the Agency has determined that adequate capacity exists for the volume of HOC wastes requiring combustion. Consequently, the Agency is today proposing a recission of the national capacity variance previously granted to these wastes.

2.2.4 First Third Wastes

(1) First Third wastes. Table 2-8 presents the estimates of all First Third wastes land disposed annually, by management practice and by type of disposal unit. These are the first of the scheduled wastes, and they are required to be evaluated by August 8, 1988. The same procedures described for the analysis of all RCRA wastes (Section 2.2.1) were used for estimating First Third waste volumes. However, in the worst-case analysis for First Third wastes, the total volume for each category in Table 2-4 represents the sum of all single First Third waste streams and all waste groups containing at least one First Third waste but no solvents. This prevents double-counting of multiple waste streams that contain both First Third wastes and solvents.

Table 2-7 Capacity Analysis for HOC Wastes
(Excluding First Third Proposed HOCs)

Technology	Available capacity (million gal/yr)	Required capacity (million gal/yr)
Combustion		
- Liquids	274	<1
- Sludges/solids	9	2
Wastewater treatment (for organics)	64	7

Table 2-8 Overview of All First Third Wastes

	Land-disposed volume[a] (million gallons/year)
Storage only	
- Waste piles	49
- Surface impoundments	6
Treatment	
- Waste piles	29
- Surface impoundments	328
Disposal	
- Landfills	302
- Land treatment	76
- Surface impoundments	71
Total	861

[a] Baseline was TSDR Survey data for 1986 (facility responses as of July 22, 1988), adjusted for volumes of waste managed in surface impoundments that will be replaced by tanks or treatment impoundments retrofit to meet minimum technology requirements.

(2) First Third promulgated wastes. Table 2-9 presents estimates of First Third promulgated wastes land disposed annually, by management practice and type of disposal unit. These are the First Third wastes for which treatment standards are being finalized today. The same procedures described for the analysis of all RCRA wastes were used for estimating First Third promulgated waste volumes. In the worst-case analysis for First Third promulgated wastes, the total volume for each category in Table 2-8 represents the sum of all single First Third promulgated waste streams and all waste groups containing at least one First Third promulgated waste but no solvents. This prevents double-counting of multiple waste streams that contain First Third promulgated wastes and solvents.

Table 2-10 presents the estimates of national capacity for the alternative technologies applicable to the First Third promulgated wastes. Also presented are the estimates of annual land disposed waste volumes requiring alternative commercial capacity excluding First Third promulgated wastes that are underground injected or soils contaminated with First Third promulgated wastes. In most cases, there is adequate available capacity to treat all of the First Third promulgated wastes and mixed waste groups containing a First Third promulgated waste.

As Table 2-10 shows, four technologies have required capacity (demand) exceeding the available capacity (supply): acid leaching of sludges, high temperature metals recovery, solvent extraction, and

Table 2-9 Overview of First Third Promulgated Wastes[a]

	Land-disposed volume[b] (million gallons/year)
Storage only	
- Waste piles	41
- Surface impoundments	4
Treatment	
- Waste piles	27
- Surface impoundments	320
Disposal	
- Landfills	274
- Land treatment	76
- Surface impoundments	70
Total	812

a First Third promulgated wastes are those wastes for which treatment standards are being finalized today.

b Baseline was TSDR Survey data for 1986 (facility responses as of July 22, 1988), adjusted for volumes of waste managed in surface impoundments that will be replaced by tanks or treatment impoundments retrofit to meet minimum technology requirements

Table 2-10 1988 Capacity Analysis for
First Third Promulgated Wastes

Technology	Available capacity (million gal/yr)	Required commercial capacity (million gal/yr)
Combustion		
- Liquids	274	<1
- Sludges/solids	7	6 - 160[a]
Stabilization	495	231[b]
Solvent extraction	1	0 - 154
Metals recovery		
- High temperature metals recovery (not secondary smelting)	34	62
Wastewater treatment		
- Chromium reduction, chemical precipitation, and settling/filtration	260	40
- Carbon adsorption and chromium reduction, chemical precipitation, and settling/filtration	12	1
Sludge Treatment		
- Acid leaching, chemical oxidation, and dewatering of sludge and sulfide precipitation of effluent	0	4

[a] 6 million gallons of non-K048-K052 wastes require sludge/solids combustion Amount of K048-K052 sludge/solids requiring combustion may be as much as 154 million gallons. The alternative BDAT technology for these wastes is solvent extraction

[b] This volume includes 62 million gallons of "high zinc" K061 also assigned to high temperature metals recovery.

combustion of sludges/solids. Therefore, because BDAT for K071 is acid leaching of the sludge, the Agency is finalizing a 2-year national capacity variance for K071 wastes.

The required capacity for the combustion of sludge/solids is divided into two numbers: the total amount of waste that requires sludge/solid combustion, 160 million gallons, and the amount of First Third promulgated waste other than K048-K052 waste that requires sludge/solids combustion, 6 million gallons. The BDAT standard for K048-K052 is also based on solvent extraction; however, because of a shortfall of sludge/solids incineration and solvent extraction capacity, the Agency is granting a 2-year national capacity variance for K048-K052 wastes.

High temperagure metals recovery (HTMR) is the BDAT for "high zinc" K061 (i.e., K061 containing $\geq$15 percent zinc). Therefore, the Agency is finalizing the 2-year capacity variance to the HTMR standard for high zinc K061. However, during this 2-year variance period, the Agency is requiring that high zinc K061 meet the standard for low zinc K061 which is based on stabilization.

The volume of land-disposed First Third promulgated wastes requiring alternative commercial treatment capacity, however, will be somewhat less than the volume presented in Table 2-9. The Agency has assumed that 35 million gallons of the 45 million gallons that were only stored in impoundments or waste piles do not require alternative treatment capacity (although they may require alternative storage capacity) because they are treated or disposed elsewhere. The 10 million gallons of "stored only" wastes that do require alternative capacity were determined to have undergone "long-term storage" and therefore would not have been reported elsewhere as treated or disposed (for more detail on "stored only" waste volumes see Section 3.1.1). Furthermore, the facility-level waste treatability and technology capacity analyses conducted on First Third wastes being land disposed determined that 341 million gallons of these wastes either had already been treated using the BDAT technology or could be treated onsite and therefore do not require alternative commercial treatment capacity. This volume includes 290 million gallons of wastewater from one facility assigned to onsite dewatering in tanks.

Based on this analysis, the Agency estimates that 436 million gallons of First Third promulgated wastes will require alternative commercial treatment capacity. This volume includes 18 million gallons of soils which are discussed in a separate section of this document; therefore, it is estimated that 418 million gallons of nonsoil First Third promulgated wastes will require alternative commercial treatment capacity. Finally, the Agency estimates that treatment of the 418 million gallons will generate 18 million gallons of waste residuals that will require additional alternative treatment capacity. In addition, the BDAT standard for "high zinc" K061 is based on high temperature metals recovery (HTMR); however, because of a lack of capacity for HTMR, EPA is today setting an interim standard for "high zinc" K061 based on stabilization. Therefore, 62 million gallons of K061 wastes have been "double-counted" on Table 2-10 under stabilization and HTMR. Also, because the BDAT for K048-K052 is based on either sludge incineration or solvent extraction, the required capacities for these technologies are presented as ranges on Table 2-10. The total volume of K048-K052 wastes requiring capacity is 154 million gallons.

(3) First Third (not promulgated) wastes. Table 2-11 presents estimates of annual land disposed volumes for "not promulgated" First Third wastes, by management practice and type of disposal unit. These are the First Third wastes for which no treatment standards are being finalized in today's rule. The same procedures described for the analyses of all RCRA wastes were used for estimating not promulgated First Third waste volumes. However, in the worst-case analysis for First Third not promulgated wastes, the total volume for each category in Table 2-11 represents the sum of all single, First Third not promulgated waste streams and all waste groups containing at least one First Third not promulgated waste, but no First Third promulgated wastes or solvents. This prevents double-counting of multiple waste streams that contain First Third not promulgated wastes, First Third promulgated wastes, and solvents.

2.2.5 Waste Code-Specific Capacity Analysis

This section presents the results of the analysis of required capacity for each alternative technology on a waste code-by-waste code

Table 2-11 Overview of First Third Wastes Not Being Promulgated[a]

	Land-disposed volume[b] (million gallons/year)
Storage only	
- Waste piles	8
- Surface impoundments	2
Treatment	
- Waste piles	2
- Surface impoundments	7
Disposal	
- Landfills	28
- Land treatment	<1
- Surface impoundments	1
Total	48

a The First Third wastes other than those wastes for which treatment standards are being finalized today

b Baseline was TSDR Survey data for 1986 (facility responses as of July 22, 1988), adjusted for volumes of waste managed in surface impoundments that will be replaced by tanks or treatment impoundments retrofit to meet minimum technology requirements basis. The tables show both the total amount of required treatment capacity for each of the First Third promulgated waste codes and the amount of required capacity for each technology. Tables 2-12 through 2-32 present waste code-by-waste code analysis of the treatment capacity required by each First Third promulgated waste.

The TSDR Survey data were sorted by waste code and type of alternative treatment required. The information was then combined and summarized to create the technology-specific and waste code-specific capacity analysis tables for First Third promulgated wastes.

Also presented are discussions for each waste code. Each discussion contains a description of the waste, identifies the hazardous constituents for which it is listed, and identifies the BDAT technology used to set the treatment standard.

For a limited number of waste streams, it was not feasible to assign them directly to the BDAT technology; therefore, the wastes were assigned to alternative technologies. In these few cases, the waste code discussions explain why the waste stream could not be directly assigned to BDAT and how the stream was handled. (Section 3.1.2 explains the methodology used to assign alternative technologies.) In addition, the Agency is not finalizing the proposed treatment standard for K106, but rather is allowing the soft hammer requirements to take effect.

F006

RCRA hazardous waste F006 is described as wastewater treatment sludges from certain electroplating operations. It is listed as a hazardous waste because of the presence of cadmium, hexavalent chromium, nickel, and cyanide (complexed). The Agency has identified the BDAT technology for nonwastewater F006 to be stabilization. The Agency had promulgated a "no land disposal" standard for F006 wastewaters; however, this standard is not being finalized. F006 wastewaters will therefore be subject to the soft hammer requirements. Table 2-12 shows the volumes of F006 estimated to require alternative treatment based on the results of the TSDR Survey. The table also identifies the alternative treatment technologies determined to be necessary for F006.

As shown in Table 2-12, most of the F006 requiring alternative treatment was assigned to the BDAT technology. Several waste streams reported in the TSDR Survey and determined to require alternative treatment were described as sludges or solids consisting of F006 and organic wastes such as K016. These waste streams were assigned to incineration with chromium reduction and chemical precipitation of the scrubber water, and stabilization of the scrubber water treatment sludge and the incinerator ash. Table 2-12 shows the volume of F006 that will require this treatment.

Several F006 waste streams reported in the TSDR Survey were described as untreated plating sludge with cyanides and metal-cyanide salts/chemicals. The Agency does not consider stabilization to be a

Table 2-12 Capacity Analysis for F006[a]

Type of alternative treatment/recovery		1988 volume needing alternative capacity (gallons/year)
Combustion of sludges/solids		253,920
Stabilization of incinerator ash		50,784
Stabilization of scrubber water treatment sludge		2,539
Stabilization		128,443,001
	Total	128,750,244

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986). Volumes do not include underground injection quantities or contaminated soils.

demonstrated technology for F006 with treatable levels of cyanides. The Agency is currently investigating the use of technologies such as electrolytic oxidation, alkaline chlorination, wet air oxidation, ozonation, and other chemical oxidation as applicable technologies for F006 wastes that contain treatable quantities of cyanide. EPA will determine which of these technologies should be the basis of the BDAT standard when these data become available later this year. Since EPA has insufficient information to establish either a separate treatability group for F006 nonwastewaters containing treatable levels of cyanide or a treatment standard for the cyanide contained in them, the Agency is identifying the treatment standard as "reserved" until a standard can be promulgated later this year. Until a standard for cyanide in F006 nonwastewaters is promulgated, those F006 nonwastewaters containing cyanides may be land disposed, as long as they do not exceed the statutory cyanide concentration prohibited under the statutory "California List" restrictions (liquid hazardous wastes containing free cyanides at concentrations of 1,000 ppm or greater). Therefore, for today's rule, the Agency has assigned these waste streams to stabilization in order to meet the California List restrictions. Also, the Agency is not setting a standard in today's rule for F006 wastewaters, but instead is allowing the soft hammer requirements to take effect.

Some commenters were concerned that commercial facilities with available stabilization capacity were not permitted specifically for F006 waste. However, Review of TSDR Survey data indicates that there is approximately 270 million gallons of existing (not planned) available capacity at facilities that accepted F006 for stabilization in 1986 or said they will accept F006 for stabilization. These facilities include GSX Services of South Carolina; CID Landfill; U.S. Pollution Control Inc.; Environmental Waste Resources; Peoria Disposal Inc.; and several CBI facilities. Because they have accepted F006 for stabilization in the past, the Agency assumes these facilities are permitted to stabilize F006 wastes. Based on the information in the TSDR Survey, the Agency believes that adequate incineration and stabilization capacity exists for F006, and is not granting a capacity variance from the ban effective date for F006 waste requiring alternative treatment.

K001

RCRA hazardous waste K001 is described as bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol. K001 is listed as a hazardous waste because of the presence of toxic organics. The Agency has identified the BDAT technology for K001 to be incineration with chemical precipitation of the scrubber water and stabilization of the scrubber water treatment sludge and incinerator ash. As shown in Table 2-13, all of the K001 identified from the TSDR Survey as requiring alternative treatment was assigned to this BDAT technology.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration and stabilization capacity exists for K001. Therefore, the Agency is not granting a capacity variance from the ban effective date for K001 wastes requiring alternative treatment.

Table 2-13 Capacity Analysis for K001[a]

Type of alternative treatment/recovery		1988 volume needing alternative capacity (gallons/year)
Combustion of sludges/solids		3,301,278
Stabilization of incinerator ash		333,224
Stabilization of scrubber water treatment sludge		33,013
	Total	3,667,515

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986) Volumes do not include underground injection quantities or contaminated soils

K016

RCRA hazardous waste K016 is described as heavy ends or distillation residues from the production of carbon tetrachloride. K016 is listed as a hazardous waste because of the presence of toxic organics. The Agency has identified the BDAT technology for K016 to be incineration. As shown in Table 2-14, all of the K016 identified from the TSDR Survey as requiring alternative treatment was assigned to this BDAT technology. The BDAT treatment of K016 would not normally require chromium reduction and chemical precipitation of the scrubber water, and stabilization of the scrubber water treatment sludge and the incinerator ash. However, because several facilities reported mixed waste streams of K016 and metal-bearing wastes, the Agency assumed that these mixed waste streams would require this additional treatment. Table 2-14 also shows the volume of K016 estimated to require this treatment.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration and stabilization capacity exists for K016. Therefore, the Agency is not granting a capacity variance from the ban effective date for K016 wastes requiring alternative treatment.

Table 2-14 Capacity Analysis for K016[a]

Type of alternative treatment/recovery		1988 volume needing alternative capacity (gallons/year)
Combustion of sludges/solids		285,120
Stabilization of incinerator ash		51,840
Stabilization of scrubber water treatment sludge		2,592
	Total	339,552

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986) Volumes do not include underground injection quantities or contaminated soils

K019

RCRA hazardous waste K019 is described as heavy ends from the distillation of ethylene dichloride in ethylene dichloride production. K019 is listed as a hazardous waste because of the presence of toxic organics. The Agency has identified the BDAT technology for K019 to be incineration. As shown in Table 2-15, all of the K019 identified from the TSDR Survey as requiring alternative treatment was assigned to this BDAT technology. The BDAT treatment of K019 would not normally require chromium reduction and chemical precipitation of the scrubber water, and stabilization of the scrubber water treatment sludge and the incinerator ash. However, because several facilities reported mixed waste streams of K019 and metal-bearing wastes, the Agency assumed that these mixed waste streams would require this additional treatment. Table 2-15 also shows the volume of K019 estimated to require this treatment.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration and stabilization capacity exists for K019. Therefore, the Agency is not granting a capacity variance from the ban effective date for K019 waste requiring alternative treatment.

Table 2-15 Capacity Analysis for K019[a]

Type of alternative treatment/recovery		1988 volume needing alternative capacity (gallons/year)
Combustion of sludges/solids		75,240
Stabilization of incinerator ash		1,416
Stabilization of scrubber water treatment sludge		100
	Total	76,756

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986) Volumes do not include underground injection quantities or contaminated soils

K020

RCRA hazardous waste K020 is described as heavy ends from the distillation of vinyl chloride in vinyl chloride monomer production. K020 is listed as a hazardous waste because of the presence of toxic organics. The Agency has identified the BDAT technology for K020 to be incineration. As shown in Table 2-16, all of the K020 identified from the TSDR Survey as requiring alternative treatment was assigned to this BDAT technology. The BDAT treatment of K020 would not normally require chromium reduction and chemical precipitation of the scrubber water, and stabilization of the scrubber water treatment sludge and the incinerator ash. However, because several facilities reported mixed waste streams of K020 and metal-bearing wastes, the Agency assumed that these mixed waste streams would require this additional treatment. Table 2-16 also shows the volume of K020 estimated to require this treatment.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration and stabilization capacity exists for K020. Therefore, the Agency is not granting a capacity variance from the ban effective date for K020 wastes requiring alternative treatment.

Table 2-16 Capacity Analysis for K020[a]

Type of alternative treatment/recovery		1988 volume needing alternative capacity (gallons/year)
Combustion of sludges/solids		14,400
Stabilization of incinerator ash		360
Stabilization of scrubber water treatment sludge		50
	Total	14,810

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986). Volumes do not include underground injection quantities or contaminated soils

K022

RCRA hazardous waste K022 is described as distillation bottom tars from the production of phenol/acetone from cumene. K022 is listed as a hazardous waste because of the presence of phenol and tars (polycyclic aromatic hydrocarbons). The Agency has identified the BDAT technology for nonwastewater K022 to be incineration followed by stabilization of the incinerator ash. For today's rule, the Agency is not finalizing the promulgated standard of no land disposal for K022 wastewaters, but instead is allowing the soft hammer requirements to take effect. Because the soft hammer requirements for K022 wastewaters will include scrubber water resulting from the incineration of K022 wastes, the Agency has not included the treatment of scrubber water in its estimates of required capacity for K022. As shown in Table 2-17, all of the K022 identified from the TSDR Survey as requiring alternative treatment was assigned to the BDAT technology.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration and stabilization capacity exists for nonwastewater K022. Therefore, the Agency is not granting a capacity variance from the ban effective date for nonwastewater K022 wastes requiring alternative treatment.

Table 2-17 Capacity Analysis for K022[a]

Type of alternative treatment/recovery		1988 volume needing alternative capacity (gallons/year)
Combustion of sludges/solids		59,520
Stabilization of incinerator ash		8,040
	Total	67,560

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986). Volumes do not include underground injection quantities or contaminated soils

K024

RCRA hazardous waste K024 is described as distillation bottoms from the production of phthalic anhydride from naphthalene. K024 is listed as a hazardous waste because of the presence of phthalic anhydride and 1,4-naphthoquinone. The Agency has identified the BDAT technology for K024 to be incineration. As shown in Table 2-18, all of the K024 identified from the TSDR Survey as requiring alternative treatment was assigned to this BDAT technology. The BDAT treatment of K024 would not normally require chromium reduction and chemical precipitation of the scrubber water, and stabilization of the scrubber water treatment sludge and the incinerator ash. However, because several facilities reported mixed waste streams of K024 and metal-bearing wastes, the Agency assumed that these mixed waste streams would require this additional treatment. Table 2-18 also shows the volume of K024 estimated to require this treatment.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration and stabilization capacity exists for K024. Therefore, the Agency is not granting a capacity variance from the ban effective date for K024 wastes requiring alternative treatment.

Table 2-18 Capacity Analysis for K024[a]

Type of alternative treatment/recovery	1988 volume needing alternative capacity (gallons/year)
Combustion of sludges/solids	195,705

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986) Volumes do not include underground injection quantities or contaminated soils

K030

RCRA hazardous waste K030 is described as column bottom or heavy ends from the combined production of trichloroethylene and perchloroethylene. K030 is listed as a hazardous waste because of the presence of toxic organics. The Agency has identified the BDAT technology for K030 to be incineration. The BDAT treatment of K030 does not require the treatment of scrubber water and incinerator ash. As shown in Table 2-19, all of the K030 identified from the TSDR Survey as requiring alternative treatment was assigned to this BDAT technology. K030 was not reported in the TSDR Survey as being mixed with any metal-bearing wastes; therefore, the treatment of scurbber water and incinerator ash for mixed waste streams was not necessary.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration capacity exists for K030. Therefore, the Agency is not granting a capacity variance from the ban effective date for K030 wastes requiring alternative treatment.

Table 2-19 Capacity Analysis for K030[a]

Type of alternative treatment/recovery	1988 volume needing alternative capacity (gallons/year)
Combustion of sludges/solids	10,560

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986) Volumes do not include underground injection quantities or contaminated soils

K037

RCRA hazardous waste K037 is described as wastewater treatment sludges from the production of disulfoton. K037 is listed as a hazardous waste because of the presence of toluene and phosphorodithioic and phosphorothioic acid esters. The Agency has identified the BDAT technology for K037 to be incineration. The BDAT treatment of K037 does not require treatment of scrubber water and incinerator ash. As shown in Table 2-20, all of the K037 identified from the TSDR Survey as requiring alternative treatment was assigned to this BDAT technology. K037 was not reported as being mixed with any metal-bearing wastes in the TSDR Survey; therefore, the treatment of scrubber water and incinerator ash for mixed waste streams was not necessary.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration capacity exists for K037. Therefore, the Agency is not granting a capacity variance from the ban effective date for K037 wastes requiring alternative treatment.

Table 2-20 Capacity Analysis for K037[a]

Type of alternative treatment/recovery	1988 volume needing alternative capacity (gallons/year)
Combustion of sludges/solids	11,131

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986). Volumes do not include underground injection quantities or contaminated soils

K044

RCRA hazardous waste K044 is described as wastewater treatment sludges from the manufacturing and processing of explosives. K044 is listed as a hazardous waste because the waste is reactive. The Agency has identified the BDAT technology for K044 to be open detonation. Based on the results of the TSDR Survey, the Agency identified two K044/K046 mixed waste streams that will require alternative treatment. K046 is also generated in the processing of explosives and is listed as a hazardous waste because of the presence of lead.

One K044/K046 mixed waste stream was reported by a commercial landfill. Based on the information reported in the TSDR Survey for this facility, the Agency assumed that the waste no longer displayed explosive properties. Therefore, the waste was no longer reactive and did not meet the characteristic of K044 waste. Because of this, the entire volume of this waste stream was treated as K046. The other K044/K046 mixed waste stream was described as "dry" lime or metal hydroxide solids not "fixed." Again, based on the information reported in the TSDR Survey, the Agency assumed that the waste stream no longer met the characteristic of K044 (reactive). Therefore, the K044 volume was treated as K046.

Based on the information in the TSDR Survey, the Agency has identified no waste streams showing the characteristic of K044 that will require alternative treatment. Therefore, the Agency is not granting a capacity variance from the ban effective date for K044 wastes.

K046

RCRA hazardous waste K046 is described as wastewater treatment sludges from the manufacturing, formulation, and loading of lead-based initiating compounds. K046 is listed as a hazardous waste because of the presence of lead. Today's rule promulgates a final treatment standard only for those K046 nonwastewaters that are nonreactive. The Agency has identified the BDAT technology for nonwastewater, nonreactive K046 to be stabilization. For today's rule, the Agency is not finalizing the proposed standards for reactive K046 and K046 wastewaters, but instead, is allowing the soft hammer requirements to take effect. As shown in Table 2-21, the volume of K046 waste identified by the Agency as requiring alternative treatment (nonreactive nonwastewaters) was assigned to the BDAT technology. Based on the results of the TSDR Survey, the Agency identified two K044/K046 mixed waste streams. One was a K044/K046 mixed waste stream reported by a commercial landfill. Based on the information reported in the TSDR Survey for this facility, the Agency assumed that the waste did not display the characteristic of K044 waste (reactive). The Agency, therefore, believes that the appropriate treatment for this waste stream is stabilization.

The second K044/K046 mixed waste stream was described as "dry" lime or metal hydroxide solids not "fixed." Again, based on the information reported in the TSDR Survey, the Agency assumed that the waste stream did not meet the characteristic of K044 waste. Therefore, the Agency assumed that the waste stream would also require stabilization.

One commenter was concerned that commercial facilities with available stabilization capacity were not permitted specifically for K046 wastes. However, a limited review of the TSDR Survey data indicates that one CBI facility stated that they are permitted for K046 and their process is capable of meeting the BDAT treatment standard. Furthermore, the existing (not planned) capacity at this facility is more than enough to handle the volume of K046 requiring stabilization.

Based on the information from the TSDR Survey, the Agency believes that adequate stabilization capacity exists for K046. Therefore, the Agency is not granting a capacity variance from the ban effective date to K046 wastes requiring alternative treatment.

Table 2 21 Capacity Analysis for K046[a]

Type of alternative treatment/recovery	1988 volume needing alternative capacity (gallons/year)
Stabilization	1,582,160

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986) Volumes do not include underground injection quantities or contaminated soils

K048 through K052

The petroleum refining industry generates five hazardous wastes listed in the Code of Federal Regulations: K048, K049, K050, K051, and K052. K048 is described as dissolved air flotation (DAF) float; K049 is described as slop oil emulsion solids; K050 is described as heat exchanger bundle cleaning sludge; K051 is described as API separator sludge; and K052 is described as tank bottoms (leaded). K048, K049, and K051 are listed for containing hexavalent chromium and lead; K050 is listed for containing hexavalent chromium; and K052 is listed for containing lead. The vast majority of waste generated by the petroleum refining industry is K048, K049, and K051. The Agency has identified the BDAT for K048-K052 waste streams to be solvent extraction followed by stabilization of residuals or incineration, with chromium reduction and chemical precipitation of the scrubber water, and stabilization of the scrubber water treatment sludge and the incinerator ash.

Table 2-22 shows the volumes of K048-K052 wastes that, based on the results of the TSDR Survey, will require alternative treatment. Table 2-22 also shows the treatment technologies assigned to the K048-K052 wastes.

Treatability analysis and assignment of treatment technologies to the petroleum refining wastes is influenced by two factors: waste composition and physical form. All five of the petroleum refining wastes can be described as an organic sludge containing metals; hence, they can be assigned to the same BDAT treatment technology.

Table 2-22 Capacity Analysis for K048-K052[a]

Waste code	Type of alternative treatment/recovery	1988 volume needing alternative capacity (gallons/year)
K048	Solvent extraction or combustion of sludges/solids	33,407,730
K048	Stabilization of solvent extraction residues or incinerator ash	3,340,773
K048	Stabilization of scrubber water treatment sludge	334,077
K049	Solvent extraction or combustion of sludges/solids	28,455,250
K049	Stabilization of solvent extraction residues or incinerator ash	2,983,115
K049	Stabilization of scrubber water treatment sludge	284,553
K049	Wastewater treatment - carbon adsorption and chromium reduction	902,640
K049	Stabilization of wastewater treatment sludge	9,026
K050	Solvent extraction or combustion of sludges/solids	10,611,680
K050	Stabilization of solvent extraction residues or incinerator ash	1,086,370
K050	Stabilization of scrubber water treatment sludge	106,117
K051	Solvent extraction or combustion of sludges/solids	70,279,848
K051	Stabilization of solvent extraction residues or incinerator ash	7,163,678
K051	Stabilization of scrubber water treatment sludge	702,798

Table 2-22 (Continued)

Waste code	Type of alternative treatment/recovery	1988 volume needing alternative capacity (gallons/year)
K052	Solvent extraction or combustion of sludges/solids	11,207,805
K052	Stabilization of solvent extraction residues or incinerator ash incineration residues	1,139,558
K052	Stabilization of scrubber water treatment sludge	112,078
	Total	172,127,096

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986). Volumes do not include underground injection quantities or contaminated soils.

Most of the petroleum refining waste, approximately 154 million gallons, were reported in the TSDR Survey as sludges (as described above) and, therefore, are assigned to the BDAT technologies. However, there were some notable exceptions. One facility described its K049 waste stream as a wastewater or an aqueous mixture. From the facility schematic, it was determined that this stream resulted from tank cleaning. The Agency believes this waste would be too low in organic content to be incinerated; instead, this stream was determined to require carbon adsorption, chromium reduction, and chemical precipitation, with stabilization of the wastewater treatment sludge. The carbon adsorption would remove the organics, followed by chromium reduction and chemical precipitation to remove the metals from the wastewater stream.

A second case was a K051 waste stream identified by a facility as an aqueous mixture. From the facility schematic it was determined that the waste stream comes from a tank that has only sludge entering it and two streams exiting, one an aqueous stream that is recycled back into the wastewater treatment plant. The stream in question is the only other stream exiting the tank, and it is then sent to land treatment. This waste stream was therefore determined to be a sludge and was assigned to sludge incineration.

There were also two cases of facilities reporting K048-K051 as organic liquids. In one case, the stream is an effluent from a dewatering tank which is sent to land treatment. This type of treatment typically results in generation of a sludge; therefore, this volume was assigned to solvent extraction or sludge/solid incineration. In the other case, however, the organic liquid enters a surface impoundment for evaporation before land treatment. Through review of the survey responses, the Agency believes that there is adequate onsite tank storage capacity to sufficiently dewater the waste without continuing to rely on land placement; therefore, only that volume of sludge that is sent to land treatment will require solvent extraction or sludge/solid incineration.

At one facility, K048-K052 wastes were reported as entering surface impoundments for dewatering (volume reduction). Rather than assuming that the entire volume that enters the surface impoundments requires alternative treatment, the Agency considered only the volume that settles out in the impoundments. The Agency believes that dewatering, which presently occurs in surface impoundments, can be done instead in existing onsite tanks.

Based on the information from the TSDR Survey, the Agency does not believe that adequate alternative capacity currently exists for K048-K052. The Agency does not believe that adequate combustion capacity will be available until 1990. Also, based on an Agency report analyzing the time required to site and construct new hazardous waste treatment facilities (Ref. 11), EPA estimates that a treatment system can generally be installed in 19 to 24 months. This estimate includes the time required for conceptual planning and design, detailed engineering design, bid solicitation and evaluation, construction, and start-up. The estimate does not include the additional time required for preparation and approval of RCRA and/or State permit applications.

Therefore, the Agency is granting a 2-year national capacity variance from the ban effective date for K048-K052 wastes requiring alternative treatment.

K061

RCRA hazardous waste K061 is described as emission control dust/sludge from the primary production of steel in electric furnaces. K061 is listed as a hazardous waste because of the presence of hexavalent chromium, lead, and cadmium. For K061 containing $\geq$15 percent zinc (high zinc K061), the Agency has identified the BDAT technology to be high temperature metals recovery. For K061 containing <15 percent zinc (low zinc K061), the Agency has identified the BDAT technology to be stabilization. The TSDR Survey does not contain data that would allow the Agency to differentiate between high zinc and low zinc K061. However, based on information from public comments on the proposed rule, the Agency estimates that 75 percent of the K061 requiring alternative treatment is high zinc K061. Table 2-23 shows the volumes of K061 waste identified by the Agency as requiring alternative treatment.

One waste stream reported in the TSDR Survey (67,920 gallons) was reported as a mixed K061 and K062 stream. After reviewing the survey information, it was determined that the waste stream had been received from an offsite facility and was directly landfilled. Because of this information and the characteristics of the waste codes involved, the Agency assumed that the waste stream is an inorganic solid. The Agency believes that these wastes will likely be segregated upon promulgation of the land disposal restrictions and, therefore, will no longer be generated as a mixed waste stream. To conservatively estimate the volumes of K061 and K062 that will require alternative treatment, the

Table 2-23 Capacity Analysis for K061[a]

Type of alternative treatment/recovery		1988 volume needing alternative capacity (gallons/year)
High temperature metals recovery		62,357,226
Stabilization		20,785,742
	Total	83,142,968

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986) Volumes do not include underground injection quantities or contaminated soils

entire volume of this waste stream was assigned to the BDAT technologies for both K061 and K062, with no resulting impact on capacity variance determinations for those wastes (see below).

The Agency believes that sufficient high temperature metals recovery capacity does not exist for high zinc K061. For the proposed rule (Ref.4, Ref. 11), EPA analyzed the length of the required to install a BDAT treatment system for K061 waste. Based on this analysis, EPA estimates that a BDAT treatment system could be constructed within two years. This estimate does not include the time required for preparation and approval of RCRA and/or State permit applications because high temperature metal-recovery is considered recycling, and as such, is exempt from RCRA permitting.

Therefore, the Agency is granting a 2-year national capacity variance from the ban effective date for K061 wastes requiring high temperature metals recovery. However, the Agency is setting an interim standard for high zinc K061 based on stabilization.

Several commenters were concerned that commercial facilities with available stabilization capacity were not permitted specifically for K061 waste. However, review of the TSDR Survey data indicates that there is approximately 205 million gallons of existing (not planned) available capacity at facilities that accepted K061 for stabilization in 1986 or said they would accept K061 for stabilization. These facilities included GSX Services of South Carolina, Peoria Disposal Inc., and several CBI facilities. Because they have accepted K061 for stabilization in the past, the Agency assumes the facilities were permitted to stabilize K061 wastes.

Based on the information in the TSDR Survey, the Agency believes that adequate stabilization capacity exists for high zinc and low zinc K061. Therefore, the Agency is not granting a capacity variance from the ban effective date for K061 wastes based on stabilization.

K062

RCRA hazardous waste K062 is described as spent pickle liquor from steel finishing operations of plants that produce iron and steel. K062 is listed as a hazardous waste because of the presence of hexavalent chromium and lead. The Agency has identified the BDAT technology for K062 to be chromium reduction followed by chemical precipitation and sludge dewatering. As shown in Table 2-24, all of the K062 identified by the TSDR Survey as requiring alternative treatment was assigned to this BDAT technology. The BDAT technology identified for K062 waste does not normally require stabilization of the wastewater treatment sludge.

One waste stream reported in the TSDR Survey (67,920 gallons) was a mixed K061 and K062 stream. After reviewing the survey for this facility, it was determined that the waste stream had been received from offsite and was directly landfilled. Because of this information and the characteristics of the waste codes involved, the Agency assumed the waste stream to be an inorganic solid. The Agency believes that these wastes will likely be segregated upon promulgation of the land disposal restrictions and, therefore, will no longer be generated as a mixed waste stream. To conservatively estimate the volumes of K062 and K061 that will require alternative treatment, the entire volume of this waste stream was assigned to the BDAT technologies for both K062 and K061. The K062 waste was assumed to require slurrying prior to chromium reduction, chemical precipitation, and sludge dewatering.

Table 2-24 Capacity Analysis for K062[a]

Type of alternative treatment/recovery	1988 volume needing alternative capacity (gallons/year)
Wastewater treatment: chromium reduction	40,114,690

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986). Volumes do not include underground injection quantities or contaminated soils.

Based on the information from the TSDR Survey, the Agency believes that adequate capacity is available for chromium reduction and stabilization (if necessary) of K062 wastes. Therefore, the Agency is not granting a capacity variance from the effective date to K062 wastes requiring these technologies.

K071

RCRA hazardous waste K071 is described as brine purification muds from the mercury cell process in chlorine production, where separately prepurified brine is not used. K071 is listed as a hazardous waste because of the presence of mercury. The Agency has identified the BDAT technology for K071 to be acid leaching followed by chemical oxidation, dewatering of sludges, and sulfide precipitation of metals in the effluent. The resultant wastewater treatment sludge from the BDAT treatment of K071 is classified as K106 waste, which is discussed later in this section. As shown in Table 2-25, all of the K071 identified from the TSDR Survey as requiring alternative treatment was assigned to this BDAT technology.

Based on the information in the TSDR Survey, the Agency does not believe that adequate capacity is available for K071 wastes. For the proposed rule (Ref. 4, Ref. 11), EPA estimated that the proposed BDAT treatment system for K071 could be installed in within two years. This estimate included the time required for conceptual planning and design, detailed engineering design, bid solicitation and evaluation, construction, and start-up. The estimate does not include the additional time required for preparation and approval of RCRA and/or State permit applications.

Therefore, the Agency is granting a 2-year national capacity variance from the ban effective date to K071 wastes requiring alternative treatment.

Table 2-25 Capacity Analysis for K071[a]

Type of alternative treatment/recovery	1988 volume needing alternative capacity (gallons/year)
Acid leaching, chemical oxidation, and dewatering of sludges and sulfide precipitation of metals in effluent	3,886,584

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986). Volumes do not include underground injection quantities or contaminated soils

K083

RCRA hazardous waste K083 is described as distillation bottoms from aniline production. K083 is listed as a hazardous waste because of the presence of aniline, diphenylamine, nitrobenzene, and phenylenediamine. The Agency is finalizing a treatment standard of no land disposal for K083 nonwastewaters with less than 0.01 percent by weight ash. For today's rule, however, the Agency is not finalizing the proposed standard of no land disposal for K083 wastewaters and for K083 nonwastewaters with greater than or equal to 0.01 percent by weight ash, but instead is allowing the soft hammer requirements to take effect. Because the TSDR Survey data does not contain the data needed to differentiate between the two subcategories of nonwastewater K083, the Agency has conseratively assumed that the entire volume of land disposed nonwastewater K083 will require alternative treatment/recovery.

As shown in Table 2-26, all of the K083 identified from the TSDR Survey as requiring alternative treatment was assigned to the BDAT technology. K083 was not reported as being mixed with any metal-bearing wastes in the TSDR Survey; therefore, the treatment of scrubber water and incinerator ash for mixed waste streams was not necessary.

Based on information from the TSDR Survey, the Agency believes that adequate incineration capacity exists for K083. Therefore, the Agency is not granting a capacity variance from the ban effective date for K083 wastes requiring alternative treatment.

Table 2-26 Capacity Analysis for K083[a]

Type of alternative treatment/recovery	1988 volume needing alternative capacity (gallons/year)
Combustion of sludges/solids	75,732

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986) Volumes do not include underground injection quantities or contaminated soils

K086

RCRA hazardous waste K086 is described as solvent washes and sludges, ink residues, and wastewaters from cleaning tubs and equipment used in the formulation of ink from pigments, driers, soaps, and stabilizers containing chromium and lead. K086 is listed as a hazardous waste because of the presence of lead and hexavalent chromium. BDAT treatment standards have been set only for K086 solvent washes and sludges. The BDAT treatment standards for K086 ink residues and wastewaters have been deferred and, therefore, are not included in this analysis. The Agency has identified the BDAT technology for K086 solvent washes and sludges to be incineration with chromium reduction and chemical precipitation of the scrubber water, and stabilization of the scrubber water treatment sludge and incinerator ash. As shown in Table 2-27, the K086 waste identified from the TSDR Survey as requiring alternative treatment was assigned to this BDAT technology.

Based on the information from the TSDR Survey, the Agency believes that adequate capacity exists for incineration and stabilization of K086 solvent washes and sludges. Therefore, the Agency is not granting a capacity variance from the ban effective date for K086 wastes requiring alternative treatment.

Table 2-27 Capacity Analysis for K086[a]

Type of alternative treatment/recovery		1988 volume needing alternative capacity (gallons/year)
Combustion of liquids		204,828
Combustion of sludges/solids		960
Stabilization of incinerator ash		2,144
Stabilization of scrubber water		2,058
	Total	209,990

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986) Volumes do not include underground injection quantities or contaminated soils.

K087

RCRA hazardous waste K087 is described as decanter tank tar sludge from coking operations. K087 is listed as a hazardous waste because of the presence of phenol and naphthalene. The Agency has identified the BDAT technology for K087 to be incineration with chemical precipitation of the scrubber water and stabilization of the scrubber water treatment sludge and the incinerator ash. As shown in Table 2-28, all of the K087 waste identified from the TSDR Survey as requiring alternative treatment was assigned to this BDAT technology.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration and stabilization capacity exists for K087. In addition, much of this waste is (or can be) recycled into the coking process. Therefore, the Agency is not granting a national capacity variance from the ban effective date for K087 wastes requiring alternative treatment.

Table 2-28 Capacity Analysis for K087[a]

Type of alternative treatment/recovery		1988 volume needing alternative capacity (gallons/year)
Combustion of sludges/solids		1,235,850
Stabilization of incinerator ash		123,585
Stabilization of scrubber water treatment sludge		12,359
	Total	1,371,794

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986). Volumes do not include underground injection quantities or contaminated soils

K101 and K102

RCRA hazardous wastes K101 and K012 are described as residues from the production of veterinary pharmaceuticals from arsenic or organo-arsenic compounds. K101 and K102 are listed as hazardous wastes because of the presence of arsenic. The Agency has identified the BDAT technology for K101 and K102 to be incineration with chemical precipitation of the scrubber water and stabilization of the scrubber water treatment sludge and the incinerator ash. The data used for the capacity analysis of K101 and K102 came from the 1985 Biennial Report data base, not the TSDR Survey. The volumes reported in Table 2-29 represent the total volume of K101 and K102 waste generated, rather than the total volume land disposed. Therefore, the volumes represent a "worst-case" conservative analysis. As shown in Table 2-29, all of the K101 and K102 wastes identified were assigned to this BDAT technology.

Based on the information from the 1985 Biennial Report data base, the Agency believes that adequate incineration and stabilization capacity exists for K101 and K102. Therefore, the Agency is not granting a capacity variance from the ban effective date for K101 and K102 wastes requiring alternative treatment.

Table 2-29 Capacity Analysis for K101 and K102[a]

Type of alternative treatment/recovery		1988 volume needing alternative capacity (gallons/year)
Combustion of sludges/solids		95,000
Stabilization of incinerator ash		9,500
Stabilization of scrubber water treatment sludge		950
	Total	105,450

[a]Baseline volumes data from the 1985 Biennial Report Data Base Volumes do not include underground injection quantities or contaminated soils

K103

RCRA hazardous waste K103 is described as process residues from aniline extraction from the production of aniline. K103 is listed as a hazardous waste because of the presence of aniline, nitrobenzene, and phenylenediamine. The Agency has identified the BDAT technology for K103 to be solvent extraction followed by steam stripping, carbon adsorption, and carbon regeneration. This BDAT was identified for liquid K103 waste streams. However, as shown in Table 2-30, only K103 sludges/solids were identified from the TSDR Survey as requiring alternative treatment. The Agency believes that incineration of the K103 sludges/solids will meet the BDAT treatment standard.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration capacity exists for K103. Therefore, the Agency is not granting a capacity variance from the ban effective date for K103 wastes requiring alternative treatment.

Table 2-30 Capacity Analysis for K103[a]

Type of alternative treatment/recovery	1988 volume needing alternative capacity (gallons/year)
Combustion of sludges/solids	66,372

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986). Volumes do not include underground injection quantities or contaminated soils

K104

RCRA hazardous waste K104 is described as combined wastewater streams generated from nitrobenzene/aniline production. K104 is listed as a hazardous waste because of the presence of aniline, benzene, diphenylamine, nitrobenzene, and phenylenediamine. The Agency has identified the BDAT technology for K104 to be solvent extraction followed by liquid incineration, steam stripping, carbon adsorption, and carbon regeneration. This BDAT technology was identified for K104 as described in 40 CFR 261.32 (wastewater); however, as shown in Table 2-31, only K104 sludges/solids were identified from the TSDR Survey as requiring alternative treatment. The Agency believes that incineration of K104 sludges/solids will meet the BDAT treatment standard.

Based on the information from the TSDR Survey, the Agency believes that adequate incineration capacity exists for K104. Therefore, the Agency is not granting a capacity variance from the ban effective date for K104 wastes requiring alternative treatment.

Table 2-31 Capacity Analysis for K104[a]

Type of alternative treatment/recovery	1988 volume needing alternative capacity (gallons/year)
Combustion of sludges/solids	16,320

[a]Baseline volumes data from TSDR Survey for 1986 (facility responses as of July 22, 1986). Volumes do not include underground injection quantities or contaminated soils

3.2.6 Contaminated Soils

Because of the unique treatability and regulatory issues associated with contaminated soils, they have been handled separately in this document. Table 2-32 presents estimates based on TSDR Survey data of the total volume of contaminated soils land disposed at Subtitle C facilities and a breakdown of the total volume land disposed per regulatory group affected by today's final rule. Contaminated soils were identified by the waste description code associated with each waste stream, and do not include contaminated debris unless specifically stated by the facility. The survey does not contain data on the volume of contaminated soils generated, only on the volume land disposed. Furthermore, no data are available on the source generating the waste volume being land disposed (e.g., corrective actions, spill cleanups, etc.)

Available capacity was first assigned to the nonsoil land-disposed wastes analyzed in this document (i.e., solvent, HOCs, and First Third promulgated wastes). The remaining capacity was then used as available for contaminated soils. Table 2-33 presents the results of the capacity analyses conducted for soils contaminated with solvents, HOC wastes (excluding First Third promulgated wastes containing HOCs) and First Third promulgated wastes .

The results show that adequate capacity exists for the volume of contaminated soils requiring stabilization (i.e., soils contaminated with metal bearing wastes). However, capacity is not adequate for the volume

Table 2-32 Volume of Contaminated Soils Land Disposed

Regulatory group	Land-disposed volume (million gallons/year)
Solvents	26
First Third (proposed) wastes	18
First Third (not proposed) wastes containing HOCs	2
All other HOC wastes	4
Other RCRA wastes	14
All RCRA wastes	64

Table 2-33 Contaminated Soils
Capacity Analysis

Technology	Available capacity (million gal/yr)	Required capacity (million gal/yr)
Combustion of soils (sludges/solids)		
- Solvents		26
- First Third promulgated	1	12
- HOCs (excluding above)		4
Stabilization of soils contaminated with:		
- Solvents (other)		<1
- Solvents (combustion residues)		10
- First Third promulgated (combustion residues)	264	6
- First Third promulgated (other)		11

of soils requiring combustion (i.e., soils contaminated with organics). Therefore, the Agency is granting a 2-year national capacity variance for contaminated soils requiring combustion.

3.0 CAPACITY ANALYSIS METHODOLOGY

This section of the background document presents a detailed discussion of the methodology (approach) and rationale for the capacity analyses to support this final rule.

Section 3.1, Data Set Generation, includes a brief discussion of the data sources and the technical review and quality control procedures associated with the creation of the new waste volume data set used for capacity analysis. Section 3.1 presents a detailed discussion of the methodology used for determination of required alternative capacity for land disposed wastes (capacity demand). Section 3.2 presents a detailed discussion on the determination of available alternative capacity (supply) and the creation of the alternative capacity data sets used for the analysis. Finally, Section 3.3 presents the methodology and the results for the comparative analysis of waste volumes and the associated demand for the alternative capacity against the supply of available capacity, to determine if adequate capacity exists to support the land disposal restrictions.

3.1 Determination of Required Treatment Capacity

This section presents a detailed discussion of the analytical methodology used to determine the demand for alternative treatment capacity required by wastes affected by today's final rule.

3.1.1 Waste Volumes Affected

As mentioned previously, this document presents an analysis of required and available treatment capacity for solvent wastes, HOC wastes, and First Third promulgated wastes, including contaminated soils. To assess the requirements for alternative treatment capacity that will result from the restrictions, it was necessary to identify waste volumes by land disposal method, waste code, and physical/chemical form. With this information, it is possible to identify which treatment technologies are applicable to the waste volumes and to determine required alternative treatment capacity.

(1) Data sources. The TSDR Survey data base described above was the primary source used to estimate waste volumes. The 1985 Biennial Report data base was used to estimate waste volumes for K101 and K102 wastes as well as waste volumes at one large commercial landfill that did not provide data in the TSDR Survey.

(2) Identification of waste volumes. Only solvent, First Third promulgated, and HOC wastes have been included in this document. These wastes were identified on a waste code basis. For solvent or First Third promulgated wastes described by a single waste code, the volume was allocated to the appropriate regulatory group (i.e., solvents or First Third promulgated).

For waste groups (mixed wastes and/or wastes described by more than one RCRA waste code), the entire volume was included in the regulatory group of the highest priority code in the group. For example, if a waste group was described by both a solvent waste code (F001-F005) and a First Third promulgated code, the entire waste volume was assigned to solvents because they were restricted prior to First Third promulgated wastes.

The solvent wastes include the following spent solvent waste stream: F001, F002, F003, F004, and F005.

The First Third promulgated wastes include those wastes identified in Table 1-1. However, not all First Third promulgated wastes have been included in the analysis of required treatment capacity. For some of the First Third promulgated wastes, a treatment standard of "No Land Disposal" was proposed because EPA has determined that these wastes are not currently generated or that they can be totally recycled. A "No Land Disposal" standard was proposed for K004, K008, K021, K036, K060, and K073 and for wastewaters from F006, K022, K046, K061, and K069 because EPA believed that these wastes are no longer generated. However, in response to commenters who noted that these wastes are being generated as landfill leachates, the Agency is not finalizing a standard for wastewaters from these wastes, but instead is allowing them to be covered by the soft hammer requirements.

Similarly, the Agency proposed a "No Land Disposal" standard for K069 waste believing it could be totally recycled and therefore no longer land disposed. However, some K069 wastes containing high levels of calcium sulfate cannot be recycled. The Agency is not finalizing the no land disposal standard for K069 wastes containing calcium sulfate. These wastes will therefore be covered by the soft hammer requirements.

EPA is, however, finalizing a standard of "No Land Disposal" for K044, K045, and K047 wastes because open burning and open detonation of reactive wastes is not considered to be land disposal.

Although the TSDR Survey contains data showing that some of the wastes discussed above were land disposed in 1986, the Agency is excluding these wastes from the analysis of required capacity for First Third promulgated wastes on the basis of more recent data obtained by EPA's BDAT Program.

HOC wastes were also identified on a waste code basis. Any waste described by a waste code listed in 40 CFR Part 261 for containing a halogenated organic (except F001-F005 solvent wastes) was conservatively assumed to be a potential California List HOC waste (i.e., contains ≥1,000 ppm HOCs). HOC wastes were identified as either "HOCs and First Third proposed," or "all other HOCs." However, because HOC wastes that are also First Third promulgated wastes and HOC waste groups that also contain a First Third promulgated waste have already been included under the capacity analysis for First Third promulgated wastes, they have been excluded from the capacity analysis for HOC wastes.

(3) Determination of affected volumes. Solvent, First Third proposed, and HOC land-disposed wastes are affected by the restrictions and will require alternative treatment capacity. Land disposal is defined under RCRA as any placement of hazardous waste into or on the land. Therefore, storage and treatment of hazardous waste in or on the land is also considered land disposal. Land disposal methods can be divided into numerous categories. Four of these methods are addressed in detail in this document: disposal in landfills; treatment and storage in

waste piles; disposal by land application; and treatment, storage, and disposal in surface impoundments. Utilization of salt dome formations, utilization of salt bed formations, and utilization of underground mines and caves are additional methods of land disposal that are affected by this rulemaking. Currently, there is insufficient information to document the volumes of First Third wastes disposed of by these last three methods; therefore, they are not addressed in the analysis of volumes and required alternative treatment capacity. Underground (deep well) injection, another form of land disposal, will be covered under a separate rulemaking; thus, the volume of underground injected wastes has not been included in this document.

Estimates of the volume of affected wastes that have been stored (but not treated or disposed of) in surface impoundments or waste piles are presented. Storage implies a temporary placement of wastes in the surface impoundment or waste pile. EPA has assumed that all of the affected wastes stored in surface impoundments are eventually treated or recycled or that they are routed to permanent disposal in other existing units. To avoid double-counting in this analysis (i.e., counting waste volumes once when they are stored and again when they are finally disposed of), the volumes of wastes reported as being stored in surface impoundments or waste piles were not included in the estimates of volumes requiring alternative treatment capacity. Nevertheless, these wastes will be affected by the restrictions and will require alternative storage capacity. However, if it were determined during the facility level analysis that wastes were being stored indefinitely in the impoundment or waste pile (i.e., long-term storage), these volumes were included as requiring alternative treatment capacity because they would not be counted elsewhere. Long-term storage of hazardous waste was determined by examining the responses to the TSDR Survey regarding waste piles and surface impoundments. If hazardous waste entered the waste pile or surface impoundment for storage in 1986 but was not reported as having been removed from the impoundment or waste pile for treatment or disposal previous to or during 1986, the waste was considered to have undergone long-term storage.

HSWA requires that all surface impoundments must be in compliance with certain minimum design and operating criteria (minimum technology requirements; see RCRA Section 3005(j) to continue receiving, treating, or storing hazardous waste beyond November 8, 1988. Furthermore, the land disposal restrictions, upon promulgation, forbid placement of restricted wastes in surface impoundments, except for treatment. These treatment impoundments, however, must meet the minimum technology standards mentioned above. Consequently, most surface impoundments will either be replaced by tanks, retrofit to meet the minimum technical standards, or closed entirely by November 1988. Because the baseline year for the TSDR Survey is 1986, however, the 1986 land disposed volumes do not reflect these changes. Therefore, a special analysis of the management of wastes in surface impoundments was conducted. As described in Section 2.1.1, if it could be determined from the survey responses or through facility followup that a treatment surface impoundment was being closed without a replacement (i.e., the surface impoundment will be bypassed because it is not crucial to effective operation of the treatment system), being replaced by tanks, or being retrofit, then the volume was dropped from further analysis of waste requiring alternative treatment capacity.

For surface impoundments used for treatment and long-term storage or for treatment and disposal that were being replaced by tanks or retrofit, it was sometimes necessary to include the volume of treatment residual generated in the impoundment in 1986 in the volume requiring alternative treatment capacity. Because the impoundment was used for long-term storage or disposal of the treatment residual, the volume was not counted elsewhere as land disposal. Assuming that the treatment residual would continue to be generated after retrofit or replacement, the volume of treatment residual generated on an annual basis, not the entire volume entering the impoundment for treatment, was included as requiring alternative treatment capacity. For example, if a facility reported that in 1986 it used a surface impoundment for treatment (settling) and disposal of a First Third promulgated hazardous waste but in 1988 it was replacing the impoundment with a settling tank, the volume of waste entering the impoundment in 1986 would not require alternative treatment capacity because it would no longer be land disposed in 1988. However, the volume that was settling for disposal in 1986 would still be generated in the tank (clarifier) in 1988 and would require alternative treatment capacity prior to disposal. The treatment residual volume would therefore be included in the volume of wastes requiring alternative treatment capacity. If, however, it was determined that the impoundment was a flow-through impoundment and only incidental settling occurred (i.e., less than 1 percent of the volume entering was settled), then it was assumed that there would be essentially no settling when replaced by a tank.

3.1.2 Treatability Analysis

Those wastes that will require alternative treatment/recovery because of the land disposal restrictions have been identified and must be analyzed to determine the types of alternative treatment required. This process is referred to as treatability analysis. This section discusses the methodology used to perform treatability analyses on the wastes identified as requiring alternative treatment/recovery. The results of the treatability analysis conducted on the waste streams used for this rulemaking are contained in a report in the public docket (Ref. 12).

(1) Waste characterization. Respondents to the TSDR Survey were asked to provide limited waste characterization, including a waste code(s) and a waste description code (A/B codes), for each waste stream being land disposed. The A/B codes classify wastes by the following general categories and also provide limited qualitative information on

hazardous constituents in the waste: inorganic liquids, sludge, solids and gases and also organic liquids, sludges, solids, and gases. The waste code and A/B codes combinations were the primary source of characterization data used to assess treatability of the wastes.

A limited number of facilities, however, did not provide these codes. If during technical review of the survey or facility followup, the facility was either unwilling or unable to provide these codes, engineering judgment was used to assign a waste description code. All available information from the survey was used to assign the waste description codes, including the survey responses and the facility schematic. These sources could provide information on previous management (e.g., whether the waste was a treatment residual), the origin of the waste (e.g., mixture ruled and derived from the rule wastes), and how the waste was being land disposed.

In addition, for F and K coded wastes for which the facility did not provide waste description codes, the waste description in 40 CFR Part 260, as well as information contained in a report characterizing these wastes (Ref. 13), was used to assign the waste to the most common physical/chemical form. Occasionally, it was not feasible to assign the waste to the most common form. For example, if the available information indicated the waste was commonly a solid but the waste was being underground injected, it was assumed to be a liquid rather than a solid.

P and U coded wastes for which the facility did not provide waste description codes were generally assigned to either off-spec or discarded products, contaminated solids, or aqueous cleanup residue, depending on the volume, management, and assumed physical form of each waste. Again, any assumptions regarding the physical form were based on any available information from the schematic or survey, including the methods of management. For example, landfilled wastes were assumed to be either sludges or solids, and underground injected wastes were assumed to be liquids. If the volume of waste without description being land disposed was large (i.e., greater than 50 tons for solids or 1,000 gallons for liquids), the waste was assumed to be a contaminated soil or aqueous waste derived from cleanup residue. This was based on the assumption that, for economic reasons, only small volumes of off-spec products are likely to be produced, and therefore only small volumes would be land disposed.

Characteristic hazardous wastes (i.e., D waste codes) for which the facility did not provide waste description codes were generally assigned a waste description based on the type of land disposal, any information from the schematic or other survey responses, and the characteristic represented by the particular D code. For example, pesticides wastes characteristically hazardous for toxicity were generally considered organic, while toxic metal wastes were considered inorganic.

(2) Treatability grouping. As previously mentioned, EPA is required to establish treatment standards for those wastes being restricted from land disposal. The Agency has the option of either specifing the use of a particular technology or setting a concentration standard based on the performance of the best demonstrated available technology (BDAT). For solvent and First Third promulgated wastes, the Agency has generally established concentration standards based on BDAT; however, EPA has established that nonwastewater HOCs require incineration (including industrial kilns).

Using the characterization data provided by the survey, the waste code and A/B code combinations, and considering the BDAT technologies identified by EPA, wastes were assessed for treatability and assigned to treatability groups. These treatability groups were then assigned to BDAT treatment, or in some cases alternative treatment, that the Agency believes is capable of meeting the BDAT treatment standard. For example, if the BDAT technology was identified as rotary kiln incineration, it was assumed that other types of incineration with the appropriate feed system would be able to achieve the BDAT standard. In addition for this analysis, reuse as fuel in an industrial kiln was also assumed to be equivalent to incineration.

Wastes with similar A/B codes that require the same BDAT were assigned to the same treatability groups. Appendix D shows the treatability groups to which the various waste code and A/B code combinations were assigned. Appendix E presents the alternative treatment/recovery technologies associated with each treatability group, and Appendix F contains a description of each alternative treatment/recovery technology.

(3) Alternative technologies. In limited cases, waste could not be assigned to the treatability group representing the BDAT treatment because the physical/chemical form of the waste was incompatible with the BDAT treatment. In these cases, an engineering analysis of the waste stream was conducted to assign the waste to an alternative technology believed capable of achieving the BDAT treatment standard. The results of these analyses for each waste stream are presented in the waste code-by-waste code discussions in Section 2.2.5. The TSDR Survey does not contain data on the performance of treatment technologies; therefore, several alternative sources (Refs. 14, 15, 16, 17, and 18) and "best engineering judgment" were required to identify potential alternatives to BDAT.

A similar analysis was conducted for waste groups (i.e., mixed wastes). Waste groups are hazardous wastes that are described by more than one RCRA waste code, and present special treatability problems in that they are often contaminated with hazardous constituents that may fall under more than one treatability group (e.g., organics and metals). Such waste groups can generally not be assigned to only the BDAT technology for one specific waste type. Instead, a treatment train that is capable of treating each waste type in the group sequentially must be developed. Often these treatment trains can be developed by combining BDAT treatments in sequence, or by adding pre- or post-treatment steps to the BDAT technology. Treatment trains were developed using the references mentioned above and engineering judgment.

(4) Treatment residuals. Treatment technologies generate residuals that create capacity demand. For example, K048 wastes require sludge incineration followed by stabilization of the incinerator ash and chromium reduction and chemical precipitation of the scrubber water followed by stabilization of the resultant wastewater treatment sludge. Based on the TSDR Survey responses, it was determined that RCRA permitted incinerators have adequate air pollution control devices (APCD) (including scrubber water treatment at those facilities with wet scrubbers) and that the facility considered the capacity of the APCD when determining the capacity of their incinerator; therefore, no attempt was made to evaluate capacity for treatment of scrubber waters. Wastewater treatment sludges requiring stabilization, however, were included in the estimate of treatment residuals requiring capacity. Consequently, in the example used above, the K048 waste stream would require incineration and stabilization capacity.

Although the entire volume would require incineration, only a portion of the original volume would require stabilization because the amount of ash and wastewater treatment sludge generated would be less than the original volume incinerated. To account for these changes in the volume within a treatment train, volume adjustment factors were developed. These factors were developed using engineering judgment and are dependent on the type of treatment and the physical/chemical form of the waste. The factor represents that percent of the original volume exiting the technology of concern. In the example used above, K048 is an organic sludge being incinerated. The volume adjustment factor used to estimate the volume of ash generated from incineration of an organic sludge is 0.1, or 10 percent of the original volume, and the volume of wastewater treatment sludge is estimated at 0.01 or 1 percent of the original volume. Therefore, if 100 gallons were incinerated, the volume adjustment factor would estimate that 10 gallons of ash and 1 gallon of wastewater treatment sludge would be produced.

(5) <u>Previous management</u>. Another important factor considered during the treatability analysis of a waste was any previous management. Using information contained in the TSDR Surveys and the facility schematics, it was possible to evaluate the previous management, if any, for wastes being land disposed. Whenever possible, the previous management of land-disposed wastes was evaluated in an attempt to determine if the waste had already been treated by the BDAT technology or a technology believed capable of achieving the BDAT treatment standard. If it could be determined that the waste had been previously treated by such a technology, the waste was assumed to meet the BDAT treatment standard.

Such wastes would therefore not be prohibited from land disposal and were consequently not included in further analysis of the volume of wastes requiring alternative treatment/recovery capacity.

(6) Wastes excluded from further analysis. Similarly, because of the unique treatability issues associated with lab packs, these wastes were not included in the volume of wastes requiring alternative treatment/recovery capacity. Furthermore, these volumes represent only a small portion of the volume of wastes affected by today's proposal. Less than 75,000 gallons of solvent, First Third Proposed, or HOC lab pack wastes were reported as land disposed in the TSDR Survey.

3.2 Determination of Available Treatment Capacity

This section presents a detailed discussion of the analytical methodology used to determine the estimates of alternative "combustion" and "other treatment/recovery" capacity available for wastes affected by today's proposed rule. These processes include combustion in incinerators or industrial kilns, solidification/stabilization, solvent and liquid organic recovery for reuse, metals recovery, acid leaching of sludges, neutralization, and wastewater treatment for cyanides, metals and organics. A discussion of combustion capacity is separate from the discussion of other treatment capacity. Combustion is predominately a single unit process system; therefore, the combustion system analysis does not require locating and quantifying a limiting unit within a treatment train of unit processes as in the analysis of other treatment systems.

3.2.1 Determination of Combustion Capacity

(1) Introduction. The combustion data set was established to determine the following data elements for incineration and reuse as fuel: (1) the utilized capacity during the base or reference year of 1986; (2) the maximum capacity during 1986 and any planned changes through 1990; (3) the unused or available capacity during the periods 1986, 1987, 1988, and 1989-1990; and (4) the possible interchange of capacity between the various hazardous waste forms (feed capabilities) for these time periods should excess capacity exist for certain forms and shortfalls exist for others. The data set was generated by technical review and engineering evaluation of the survey responses, transfer of data to computer data entry sheets, and eventual data consolidation and aggregation to arrive at national totals.

At this time, only commercial facility capacity data are included in the data set. This represents the most readily available capacity, on a national level, to treat the waste that is currently being considered under the land disposal restrictions rule. Because of time constraints, the capacity indicated by the commercial data set does not include information on two other potential categories of waste treatment capacity, limited commercial and captive facility capacity. "Limited commercial" facilities are those that accept wastes from only a limited number of facilities not under the same ownership--in many cases, only from their customers and/or clients. "Captive facilities" are those that treat wastes from other facilities under the same ownership. Data are not yet available to include this analysis. However, the Agency does not believe that a significant amount of available capacity will result from these sources.

The capacity data set was compared to estimates of waste volumes currently being land disposed that will require combustion capacity, to determine if there is adequate incineration and reuse as fuel capacity for all waste forms. Combustion technologies lend themselves well to wastes that are difficult to treat by conventional treatment technologies, and are very versatile in that they can treat the various waste forms (liquids, solids, sludges, and gases) with some interchangeability.

(2) Approach and methodology. The data set was generated by review and engineering evaluation of TSDR Survey responses, transfer of data in the questionnaires to computer data entry sheets, and final consolidation of all facility capacities to arrive at national totals.

The questionnaires pertaining to incineration and reuse as fuel in the TSDR Survey were Questionnaire B, "Incineration," and Questionnarie C, "Reuse as Fuel," respectively. A copy of the two questionnaires can be found in the docket for this proposed rule (Ref. 6). The questionnaires were designed not only to provide actual utilization and maximum capacity data by facility, but also to provide other design and operational information to enable the reviewer to evaluate the accuracy of the facility responses. These other data elements were:

- Operating/downtime information;
- Percent utilization;
- Maximum practical thermal rating;
- Average heating value of the hazardous and nonhazardous waste being treated;
- Maximum practical feed rate for each waste form;
- Planned capacity increases/decreases by time period;
- Type of solids that can be fed to the unit; and
- Waste characteristics that exclude or limit acceptance for treatment.

The above information was used by the reviewer, using heat balances and other methods, to evaluate the validity of the facility responses to utilized and maximum capacity questions and to determine if additional maximum capacity was available over and above what the facility reported. If additional capacity was apparent, the reviewer would contact the facility by telephone to verify such findings and, if agreeable to the facility, would adjust the data.

In addition, technical review of reported capacity data included the evaluation of incinerator or kiln support systems such as waste feed handling systems, air pollution control devices, scrubber water treatment systems, and ash handling systems.

The types of incinerators considered in the TSDR Survey were as follows:

- Liquid injection
- Rotary (or rocking) kiln
- Rotary kiln with liquid injection
- Two stage
- Fixed hearth

- Multiple hearth
- Fluidized bed
- Infra-red
- Fume/vapor
- Pyrolytic destructor
- Other (specify).

The types of units that were considered in the Reuse as Fuel questionnaire were as follows:

- Cement kiln
- Aggregate kiln
- Asphalt kiln
- Other kiln (specify)
- Blast furnace
- Sulfur recovery furnace
- Smelting, melting, or refining furnace
- Coke oven
- Other furnace (specify)
- Industrial boiler
- Utility boiler
- Process heater
- Other reuse as fuel (specify).

The computer data sheets used to gather capacity data from Questionnaires B and C included the following information (brief explanation of each data element):

1. Facility ID - The USEPA identification number for the facility.

2. Facility Name

3. Unit No. - data was gathered on a unit basis since some facilities have more than one incinerator or kiln

3. Commercial status - the two commercial categories are (1) commercial - accepts waste from the general public and (2) accepts waste from a limited number of facilities not under the same ownership

5. Unit type - a code for the type of incinerator (kiln, industrial furnace, or boiler) as described earlier

6. Fixed or Mobile unit (F/M)

7. Exempt (Y/N) - RCRA permit status

8. Thermal Rating, MBtu/hr

9. Waste Feed Mix (Y/N)

   (a) liquid
   (b) sludge
   (c) solids
   (d) gases

10. Unique (Y/N): If yes, explain.

11. Capacity 1986

    A. Hazardous Waste Quantity - this amount represents the quantity of RCRA hazardous waste treated in the subject unit during calendar year 1986. This quantity is also referred to as utilized capacity.

    B. Nonhazardous Waste Quantity - this is the quantity of nonhazardous waste that was treated in the same unit, either concurrently or separately, during 1986.

    C. Hazardous Waste Maximum Quantity (Capacity) - the maximum quantity of hazardous waste that the treatment unit could have treated during 1986.

    D. All Waste Maximum Quantity (Capacity) - the maximum quantity of both hazardous and nonhazardous waste that could have been treated in 1986.

The above data were used to manually tabulate and develop the combustion capacity data set, the results of which will be discussed in Section 3.2.3, Development of the Treatment Capacity Data Set and Results.

The data are compiled in a personal computer data base, for more convenient data management. A copy of the PC data sheets, along with a description of their use, may be found in Ref. 19.

To determine flexibility in the proportion of waste capacity by physical form and to determine whether early startups of planned units had occurred, several facilities were contacted. The results of the telephone contact indicated that one rotary kiln with liquid injection unit planned for 1989 has already started up and is operational. The national capacity estimates for 1988 were prepared by using the capacity from this new unit and assessing the potential for varying capacity to manage several physical forms at rotary kilns with liquid injection.

To make the necessary comparisons for this analysis, it was required that the original facility responses be converted to one standard unit, volume in gallons. Data reported in short tons (2,000 lb/ton) by the facility were consistently converted to gallons by using a conversion factor of 240 gallons/ton (based on the density of water) for all waste forms other than gases. Gases are reported in standard cubic feet (SCF) in the initial data and were converted to tons by assuming an average molecular weight of 29. However, the analyses were done in the appropriate units (e.g., tons for solids) and simply converted to gallons for consistent presentation of units.

Data through 1990 are presented because the long-range plans of many facilities extend to these latter years, and projections of future capacity may be necessary for variance determinations. It is also assumed that the unit installations reported as operational in 1986 with no closure dates reported will continue to operate through 1990.

Although the TSDR Survey has been in progress for almost 12 months, some facilities (about 5 percent) that have not yet returned their completed survey as of July 22, 1988. Among these, there could be a few facilities that operate or plan to operate commercial incinerators or kilns. This fact is especially applicable to facilities with cement kilns, many of which were identified after the initial mailout and thus received the survey late. Cement kilns are rapidly expanding into the hazardous waste management industry because of favorable economic factors. The cement kilns burn primarily hazardous waste organic liquids such as waste solvents and waste oils. However, a small number of these kilns are considering possibly accepting limited amounts of sludges and solids. Thus the capacities of these late kilns will not have a significant affect on today's proposed rule because the available capacity for liquid combustion is already greater than that required and the available capacity for sludges/solids from the late kilns is expected to be small.

Since July 22, 1988, was the cutoff date for data for the analysis to support this final rule, the data set may be an underestimate of available combustion capacity at this time because of late facilities. The Agency has made every effort to encourage these facilities to participate in a timely fashion in the survey. The data set will be updated as these late facilities return their surveys.

3.2.2 Determination of Other Treatment System Capacities

The capacity data set also includes data on treatment systems other than combustion that may be able to treat solvents, First Third wastes, and California List wastes down to their respective treatment standards. These technologies include solidification/stabilization, solvent and liquid organic recovery for reuse, metals recovery, and wastewater treatment processes. Because the TSDR Survey data for these treatment processes are reported on a unit process basis, a method was developed to derive a system capacity from the unit process data. The results of this analysis were aggregated into a hazardous waste treatment system capacity data base (PC-based) for comparison with required capacity.

(1) Unit process capacity. The TSDR Survey obtained capacity data on a process-specific basis. A process is defined in the TSDR Survey as one or more units of equipment acting together to perform a single operation on a waste stream. A system is defined in the TSDR Survey as one or more processes that work together to treat a waste stream. Figure 3-1 presents the process codes provided for the TSDR Survey respondent to report his treatment process information.

During technical review, three different interpretations of the process capacity questions were identified, which determined the method of system capacity analysis to be employed.

Case I: Each unit process was reported separately. In such a case, process units must be agglomerated into treatment systems so that the capacity of the systems may be calculated from the reported maximum and utilized process capacities.

Figure 3-1

PROCESS CODES

These process codes were developed specifically for this survey to describe the onsite hazardous waste management operations at a facility.

TREATMENT AND RECYCLING

Incineration/thermal treatment

1I Liquid injection
2I Rotary (or rocking) kiln
3I Rotary kiln with a liquid injection unit
4I Two stage
5I Fixed hearth
6I Multiple hearth
7I Fluidized bed
8I Infra-red
9I Fume/vapor
10I Pyrolytic destructor
11I Other incineration/thermal treatment

Reuse as fuel

1RF Cement kiln
2RF Aggregate kiln
3RF Asphalt kiln
4RF Other kiln
5RF Blast furnace
6RF Sulfur recovery furnace
7RF Smelting, melting, or refining furnace
8RF Coke oven
9RF Other industrial furnace
10RF Industrial boiler
11RF Utility boiler
12RF Process heater
13RF Other reuse as fuel unit

Fuel blending

1FB Fuel blending

Solidification

1S Cement or cement/silicate processes
2S Pozzolanic processes
3S Asphaltic processes
4S Thermoplastic techniques
5S Organic polymer techniques
6S Jacketing (macro-encapsulation)
7S Other solidification

Recovery of solvents and liquid organics for reuse

1SR Fractionation
2SR Batch still distillation
3SR Solvent extraction
4SR Thin-film evaporation
5SR Filtration
6SR Phase separation
7SR Dessication
8SR Other solvent recovery (including pretreatment)

Recovery of metals for reuse

1MR Electrolytic
2MR Ion exchange
3MR Reverse osmosis
4MR Solvent extraction
5MR Secondary smelting
6MR Liming
7MR Evaporation
8MR Filtration
9MR Sodium borohydride
10MR Other metals recovery (including pretreatment)

Wastewater treatment

Equalization
1WT Equalization

Cyanide oxidation
2WT Alkaline chlorination
3WT Ozone
4WT Electrochemical
5WT Other cyanide oxidation

General oxidation (including disinfection)
6WT Chlorination
7WT Ozonation
8WT UV radiation
9WT Other general oxidation

Chemical precipitation
10WT Lime
11WT Sodium hydroxide
12WT Soda ash
13WT Sulfide
14WT Other chemical precipitation

Chromium reduction
15WT Sodium bisulfite
16WT Sulfur dioxide
17WT Ferrous sulfate
18WT Other chromium reduction

Complexed metals treatment (other than chemical precipitation by pH adjustment)
19WT Complexed metals treatment

Emulsion breaking
20WT Thermal
21WT Chemical
22WT Other emulsion breaking

Adsorption
23WT Carbon adsorption
24WT Ion exchange
25WT Resin adsorption
26WT Other adsorption

Stripping
27WT Air stripping
28WT Steam stripping
29WT Other stripping

Evaporation
30WT Thermal
31WT Solar
32WT Vapor recompressión
33WT Other evaporation

Filtration
34WT Diatomaceous earth
35WT Sand
36WT Multimedia
37WT Other filtration

Sludge dewatering
38WT Gravity thickening
39WT Vacuum filtration
40WT Pressure filtration (belt, plate and frame, or leaf)
41WT Centrifuge
42WT Other sludge dewatering

Air flotation
43WT Dissolved air flotation
44WT Partial aeration
45WT Air dispersion
46WT Other air flotation

Oil skimming
47WT Gravity separation
48WT Coalescing plate separation
49WT Other oil skimming

Other liquid phase separation
50WT Decanting
51WT Other liquid phase separation

Biological treatment
52WT Activated sludge
53WT Fixed film—trickling filter
54WT Fixed film—rotating contactor
55WT Lagoon or basin, aerated
56WT Lagoon, facultative
57WT Anaerobic
58WT Other biological treatment

Other wastewater treatment
59WT Wet air oxidation
60WT Neutralization
61WT Nitrification
62WT Denitrification
63WT Flocculation and/or coagulation
64WT Settling (clarification)
65WT Reverse osmosis
66WT Other wastewater treatment

OTHER PROCESSES (TREATMENT OR RECOVERY)

1TR Other treatment
2TR Other recovery for reuse

ACCUMULATION

1A Containers
2A Tanks

STORAGE

1ST Container (i.e., barrel, drum)
2ST Tank
3ST Waste piles
4ST Surface impoundment
5ST Other storage

DISPOSAL

1D Landfill
2D Land treatment
3D Surface impoundment (to be closed as a landfill)
4D Underground injection well

Case II: The same process was conducted in several different units (tanks or surface impoundments) that are found in different systems. The capacity of each unit process was combined and reported as one process by the facility. Responses to the tank and/or surface impoundment questionnaires were used to obtain the utilized capacity of each tank and/or surface impoundment using the process of concern. The maximum capacity of these tanks and/or surface impoundments was obtained by facility contact. The unit process data were then agglomerated into treatment systems as in Case I.

Case III: Survey respondent reported the entire treatment system as one process. The utilized and maximum capacities reported for the process were used to represent the entire system. If the individual unit processes that make up the treatment system could not be identified by examining the facility schematic and responses to other questions in the survey, the facility was contacted to obtain that information. The respondent's system data were then inputted into the capacity data set.

Upon completion of technical review the following information was obtained and examined prior to use in the system capacity analysis:

- All processes that compose the system and the units in which they occur were identified and a flow diagram constructed;
- The amount of hazardous and nonhazardous waste that enters and leaves the system was quantified such that a mass balance around the system could be conducted;
- The utilized and maximum capacities of each unit were determined;
- If surface impoundments were used in the treatment system, it was determined whether they met minimum technological requirements. The effect of closing, retrofitting, or replacing the surface impoundment with a tank or new minimum technological surface impoundment on system capacity was determined.
- Also noted were any other planned changes to the system and how they may affect the maximum capacity of the unit and/or system.

(2) Hazardous waste treatment/recovery system identification. Using the facility flow diagram with revisions made as a result of technical review, hazardous waste treatment/recovery systems and their respective

unit processes were identified. For purposes of the capacity analysis, a hazardous waste treatment/recovery system was identified by each hazardous waste entry point into a unit process or sequence of unit processes. The system begins at the process unit where the hazardous waste stream(s) first enters and consists of all other treatment or recovery process units downstream from the point of entry.

The following examples demonstrate system identification. Figure 3-2 shows a simple hazardous wastewater treatment system. Hazardous waste can enter the three unit processes for treatment at only one point, the chemical precipitation process. Therefore, there is only one hazardous waste treatment system. The system consists of chemical precipitation, clarification/settling, and sludge dewatering (filter press) processes. Note that by this method, recycle streams and nonhazardous waste streams do not affect system identification.

Figure 3-3 depicts three hazardous waste treatment systems. Three hazardous waste entry points exist at three different units, which perform three different processes. The chromium waste treatment system consists of chromium reduction, chemical precipitation of chromium, settling, and sludge dewatering processes. The cyanide waste treatment system consists of a cyanide oxidation process followed by chemical precipitation of metals, and settling and dewatering of the resultant treatment sludge. The third is a treatment system for a general metal-containing waste consisting of chemical precipitation of metals,

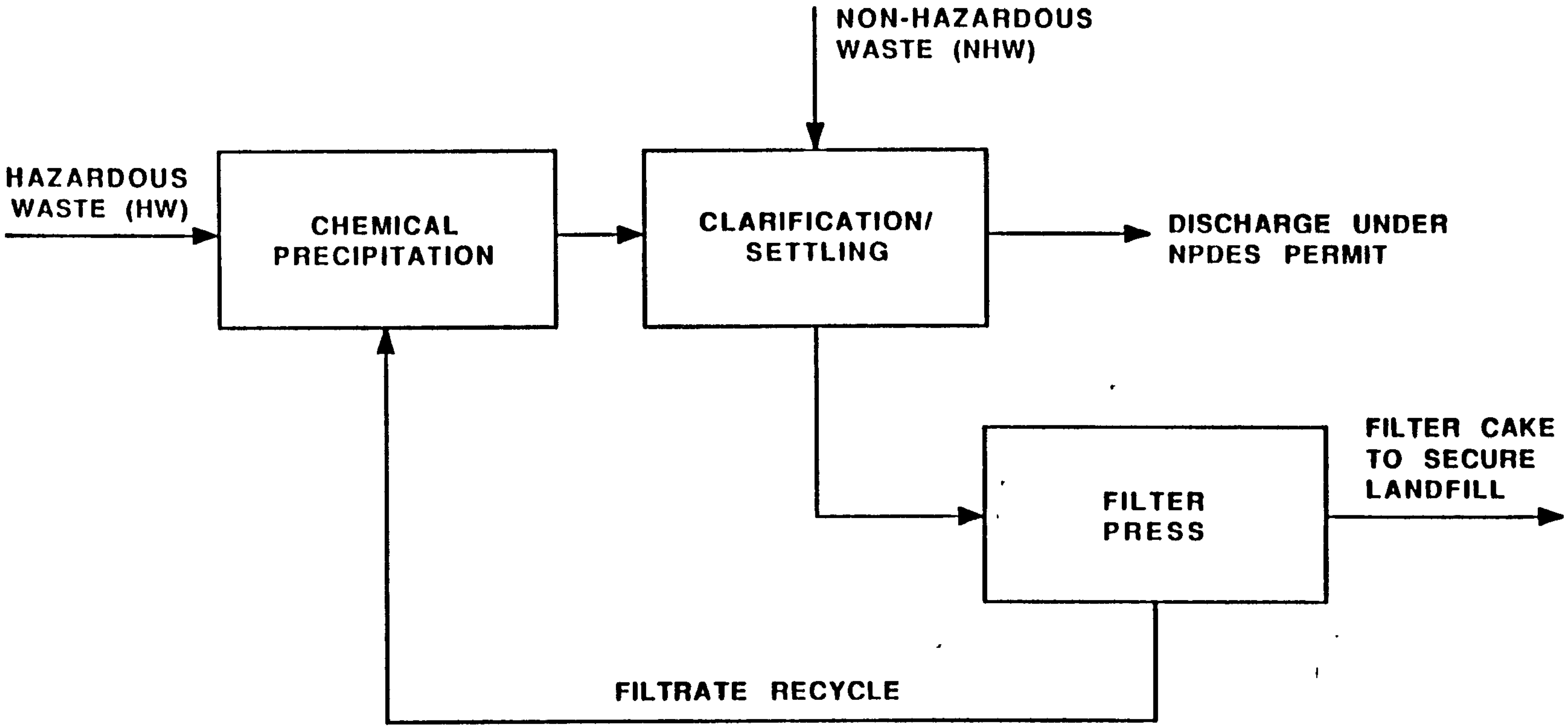

Figure 3-2 **FLOW DIAGRAM OF A SIMPLE SYSTEM**

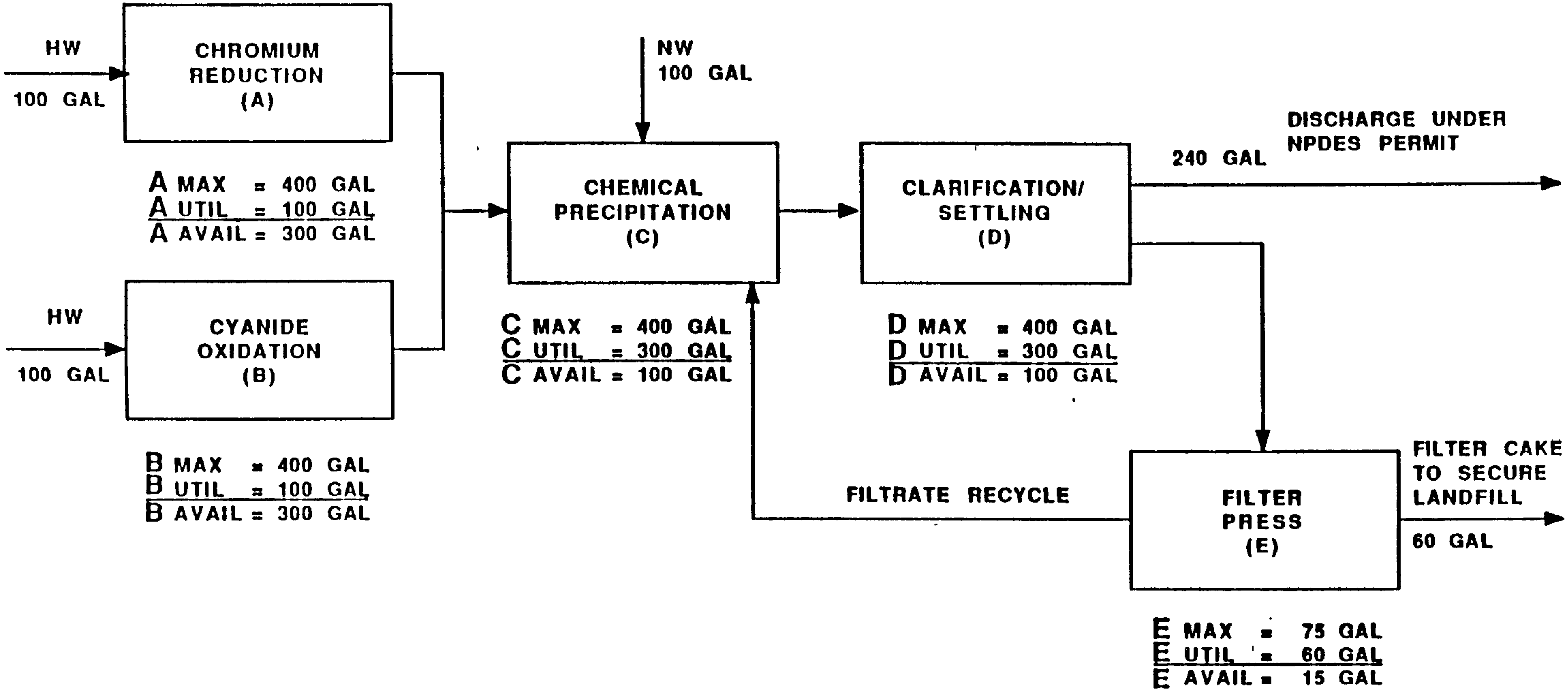

Figure 3-3 **FLOW DIAGRAM OF THREE SYSTEMS WITH UNIT PROCESS CAPACITIES**

settling, and sludge dewatering. Note that the three systems share some of the same unit processes. These three systems may be linked together by competing for the capacity of the shared units. If system capacity determination reveals that at least one of the shared units limits the capacity of at least one of the treatment systems, then the three systems are considered linked systems.

At first glance, Figure 3-4 appears to show two systems because there are two hazardous waste entry points. Upon close examination, it can be seen that the two waste streams feed into two different tanks that conduct the same process in parallel. For purposes of capacity analysis, these two units are considered as one process, with the utilized and maximum capacities of the "agglomerated unit" equal to the sum of the utilized and maximum capacities of each of the individual units. Therefore, Figure 3-4 depicts only one hazardous waste treatment system.

(3) Determination of system capacity. To determine the capacity of a treatment system, the utilized and maximum capacity of each unit process must be examined. Where several systems share unit processes, such as in Figure 3-3, all the unit processes that make up each of the potentially linked systems must be considered together for this portion of the analysis.

The capacity determination takes a "snapshot" approach, treating batch and continuous processes similarly by conducting a mass balance based on the amount of waste that was treated and could be treated during

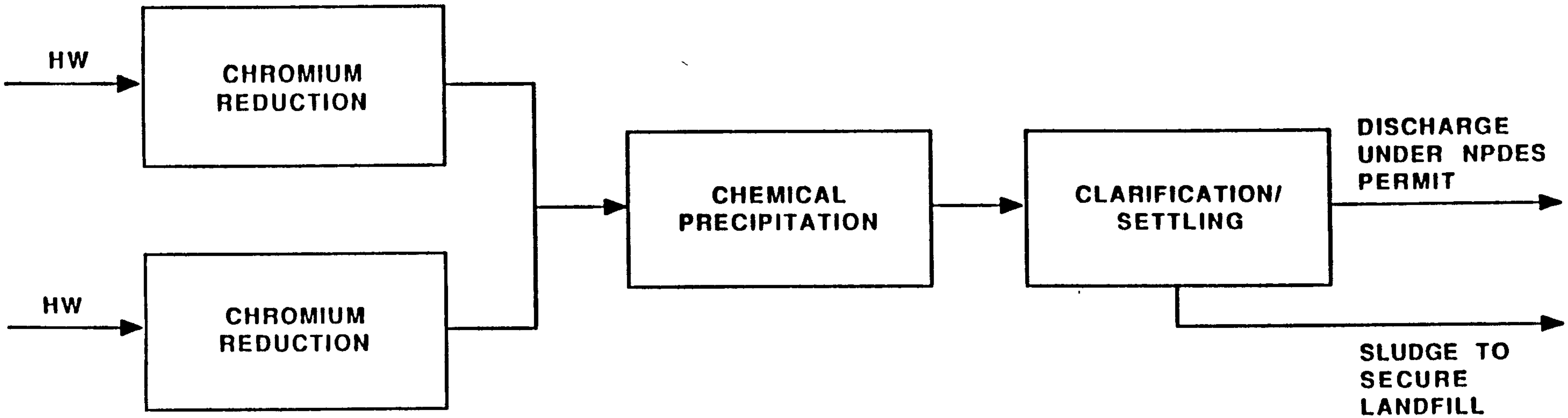

Figure 3-4 **FLOW DIAGRAM OF ONE SYSTEM WITH TWO UNITS CONDUCTING THE SAME PROCESS**

the entire year. Survey respondents reported unit capacities as the amount of hazardous waste entering the unit in 1986, the amount of nonhazardous waste entering the unit in 1986, the hazardous waste maximum capacity, and all waste maximum capacity. Volumes from internal recycle streams are considered in the volumes respondents reported for utilized and maximum unit capacities; therefore, recycle streams are not considered separately when conducting systems analysis.

The available capacity for each unit was calculated by subtracting the utilized from the maximum capacity. The available capacities of upstream units were compared with each unit in the process string to locate the limiting unit(s) in the system(s). The overall system capacity was based on the restrictions imposed by the limiting unit.

The above methodology assumes a 1986 baseline for hazardous and nonhazardous wastes already being treated in the system and uses only that portion of the system's remaining capacity that the respondent claims may be used for hazardous waste treatment. It was assumed that when a survey respondent reported hazardous waste maximum capacity to be less than all waste maximum capacity the respondent considered how much nonhazardous waste must be treated using the system when reporting the hazardous waste maximum capacity for the unit.

The available capacity of a simple system is the available capacity of the limiting unit. In Figure 3-5, B is the limiting unit because it has the smallest available capacity. If one were to try to treat 50

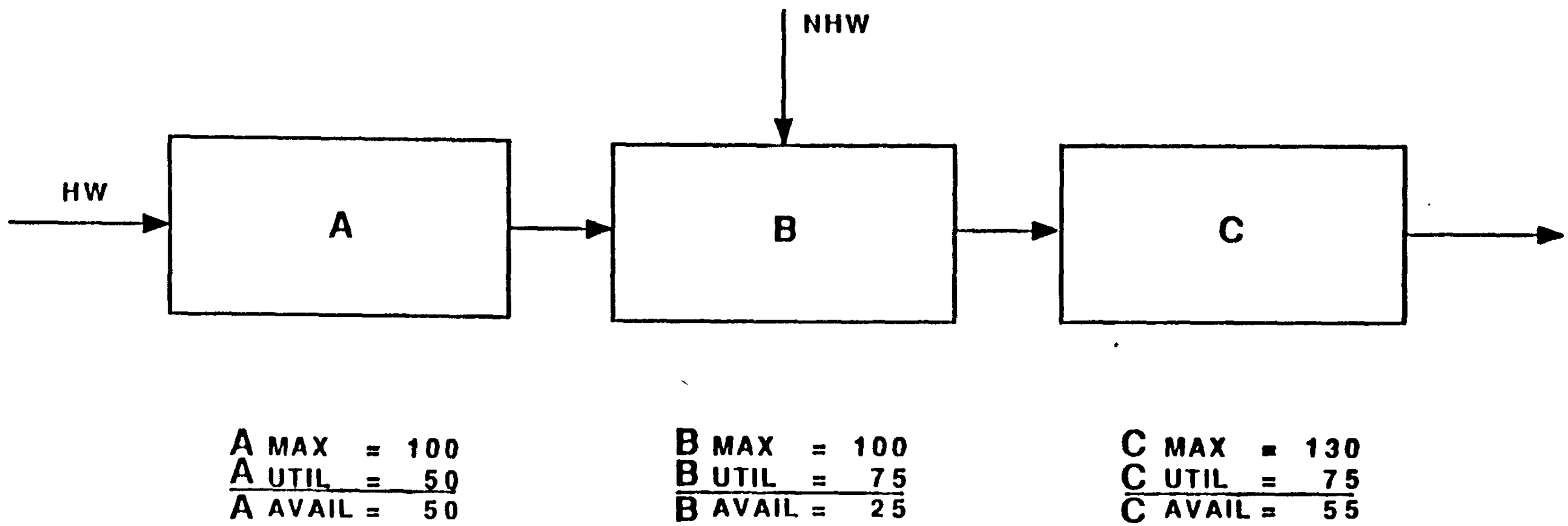

Figure 3-5 FLOW DIAGRAM WITH UNIT CAPACITIES

gallons of additional hazardous waste using this system, there would be a bottleneck at unit process B because it has room for only an additional 25 gallons of waste. Therefore, the system has only 25 gallons of available hazardous waste treatment capacity. The maximum hazardous waste treatment system capacity would be 75 gallons, or 50 gallons of hazardous waste capacity already utilized plus the additional 25 gallons of available capacity based on limiting unit B.

When analyzing more complicated systems, care must be taken that the total available capacities that affect a downstream unit are considered. Referring to the unit capacities provided in Figure 3-3, if the amount of waste being treated in units A and B were increased by 300 gallons in each unit (i.e., if they were run at their maximum capacities), unit C would become a bottleneck because it has only 100 gallons of available capacity. In other words, when units directly upstream of the unit of concern are in parallel, one must add the available capacities of the upstream units before comparing them with the available capacity of the unit of concern to determine whether that unit limits (imposes a restriction on) the maximum capacity of the upstream units (Example: $A_{Avail} + B_{Avail} = 600$ gal and 600 gal $> C_{Avail}$).

The effective available capacity of an upstream unit must be calculated for comparison with the downstream unit's available capacity when only a portion of the waste treated in the upstream unit is also treated in the downstream unit of concern. Referring to Figure 3-3, the effluent stream from the clarifier being discharged under NPDES permit must be considered when determining the effect of using the available capacity of the clarifier on the available capacity of the filter press. That fraction of waste being treated in the upstream unit that continues to the downstream unit is calculated. Under the assumption that as the utilized capacities of these units are increased the percent of waste that is treated in both upstream and downstream units remain constant, the calculated percent is applied to the reported available capacity of the upstream unit before comparing that capacity with the available capacity of the downstream unit.

In Figure 3-3, fraction of waste (D_p) going from the clarifier to the filter press (Unit E) is calculated by:

$$D_p = \frac{E_{util}}{D_{util}} = \frac{60}{300} = 0.2$$

Twenty percent of the waste treated by unit D gets treated by unit E. Now the available capacity of the clarifier affecting the filter press (D_{eal}) is calculated:

$$D_{eal} = (D_p)\ (D_{avail}) = (0.2)\ (100) = 20 \text{ gallons}$$

If the amount of waste being treated in the clarifier is increased to its maximum capacity then 20 more gallons of waste would flow to the filter press. Comparing the effective available capacities, however, indicates that the filter press limits the maximum capacity reported for the clarifier:

$$E_{avail} < D_{eal} \text{ or } 15 \text{ gallons} < 20 \text{ gallons}$$

Considering the fact that the filter press limits the maximum capacity of the clarifier, the "new" available capacity of the clarifier must be compared to the capacity of the upstream unit, the chemical precipitation unit. The limiting effect of the filter press on the available capacity of the clarifier (D_{nac}) is quantified as follows:

$$D_{nac} = \frac{E_{avail}}{D_p} = \frac{15}{0.2} = 75 \text{ gallons}$$

Based on the comparison of the "new" available capacity of the clarifier with the upstream chemical precipitation unit and the earlier comparison made between the chemical precipitation unit and the parallel upstream units, the filter press limits the capacities of all the other units in the process string.

At this point, the capacity analysis switches from a unit-by-unit analysis to a systems analysis. The affect of the limiting unit on the system's available and maximum capacity is determined. As previously discussed, Figure 3-3 shows three hazardous waste treatment systems. The utilized capacity of each of these systems is the amount of waste that enters each system for its respective treatments. The utilized capacities for the chromium waste treatment, cyanide waste treatment, and metals waste treatment are 100 gallons each. The available capacity of each system, as determined by the effect of the limiting unit, is 75 gallons. This quantity, which was derived above, reflects the effluent stream that exits the systems upstream from the limiting filter press. The maximum capacity of each system equals the utilized capacity of the system plus the available capacity of the system. The maximum capacities of the chromium waste, cyanide waste, and metals waste treatment systems equal 175 gallons each.

When waste treatment systems share a limiting unit, as exemplified by the three systems shown in Figure 3-3, they compete for the available capacity of that limiting unit. Because of this competition for scarce capacity, these linked systems cannot all operate at their maximum capacities as calculated above. A linked system can operate at its maximum capacity only if all the other systems to which it is linked continue to operate at the utilized capacities reported for 1986. The maximum capacities of each of the linked systems serve as end points when trying to find sufficient capacity for waste volumes requiring treatment. Using the example shown in Figure 3-3 to illustrate, if additional chromium waste is sent to the chromium treatment system, then there is that much less additional capacity for cyanide waste and metals waste treatment. If the chromium waste treatment system operates at maximum capacity, then no additional waste may be sent to the cyanide waste or metals waste treatment system. A methodology was developed so that capacity tradeoffs may be made between linked systems, using more available capacity for the crucial treatment system at the expense of the maximum capacities of the other, less crucial linked systems. Tradeoffs would be determined by the demand, as quantified by the required capacity analysis, for the various types of treatment systems.

To avoid overestimating of available treatment capacity and to provide a starting point upon which available capacity tradeoffs between linked systems may be made, a proportioned system capacity is calculated for linked systems. The proportioned system capacity is based on how much of the limiting unit's capacity was devoted to each linked system during the TSDR Survey base year of 1986. First, the fractional flow of hazardous waste contributed by each linked system to the limiting process is determined. Using the systems shown in Figure 3-3:

Fractional flow of chrome treatment system = CR_p

Fractional flow of cyanide treatment system = CN_p

Fractional flow of metals treatment system = M_p

$$CR_p = \frac{CR_{util}}{CR_{util} + CN_{util} + M_{util}} = \frac{100}{100 + 100 + 100} = \frac{100}{300} = 0.333$$

$$CN_p = 0.333; \; M_p = 0.333$$

Note that M_{util} is the utilized capacity of the metals treatment system, not the utilized capacity of the chemical precipitation unit. The utilized capacity of the chemical precipitation unit is the sum total of the utilized capacities of all three systems.

The effect of the limiting unit on each available system capacity is proportioned to each system based on the fractional flow determination. Continuing the calculation to determine the proportioned available capacity (CR_{pac}) using the above example:

$$CR_{pac} = (CR_p)\,(D_{nac}) = (.333)\,(75) = 25 \text{ gallons}$$

$$CN_{pac} = (CN_p)\ (D_{nac}) = 25 \text{ gallons}$$

$$M_{pac} = (M_p)\ (D_{nac}) = 25 \text{ gallons}$$

Note that D_{nac}, the previously calculated "new" available capacity of unit D, reflects the effect that the limiting unit has on all three systems and accounts for the effluent stream that exits the system before reaching the limiting unit.

When a linked system has an unshared limiting unit upstream from the mutually shared limiting unit of the other linked system(s), the system's calculated proportioned available system capacity must be compared with the available capacity of its limiting unit. If the limiting unit's available capacity is less than the calculated proportioned available system capacity, the final proportioned available system capacity equals the available capacity of the unshared limiting unit. The remainder of the calculated proportioned available system capacity is redistributed to the remaining linked systems based on how much the mutually shared limiting unit is devoted to the remaining linked systems. In the example shown in Figure 3-3, the limiting unit for all three systems is the shared filter press; therefore, no comparisons are necessary.

The proportioned maximum system capacity equals the utilized system capacity plus the proportioned available system capacity. The proportioned maximum system capacities (PMC) for the systems displayed in Figure 3-3 are:

$$CR_{PMC} = CR_{util} + CR_{pac} = 100 + 25 = 125 \text{ gallons}$$

$$CN_{PMC} = 125 \text{ gallons}$$

$$M_{PMC} = 125 \text{ gallons}$$

(4) <u>Projections of available capacity</u>. The TSDR Survey obtained capacity data for the baseline year 1986 and for changes or new operations planned through 1992. Only capacity data presented for the years 1986, 1987, 1988, and 1989-1990, were used to support the First Third promulgated rule. Projections of capacity beyond 1986 were obtained from the TSDR Survey by engineering analysis of information regarding new treatment/recovery systems being installed and equipment changes being made to the systems operating in 1986 that result in changes in system capacity.

For new systems, capacity analysis was conducted as described above and the results were input into the treatment system PC data base for the appropriate years. Reported equipment changes to treatment systems operating in 1986 were examined to determine their affect on the system capacity. If the change involved the system's limiting unit or influenced the effect of a limiting unit on the system, then capacity analysis was performed again, incorporating the capacity changes for that year.

3.2.3 Development of the Treatment Capacity Data Set and Results

The treatment/recovery capacity data set consists of a PC incineration/reuse as fuel data set and a PC other treatment systems data set. System capacity data derived from data reported in the TSDR Survey, as described above, were entered onto PC data entry sheets. The purpose of these forms was to standardize information required for assessing available treatment capacity that was to be obtained from the TSDR Survey and entered into a PC data base. The PC data base is described in a report that may be found in the docket for this proposed rule (Ref. 20). A detailed discussion of the PC data entry sheets may also be found in the docket for this proposed rule (Ref. 19).

The following discussion presents the results of the incineration/reuse as fuel data set.

(1) Incineration/reuse as fuel data set results. Table 3-1 summarizes the commercial capacity for hazardous waste incineration. This table presents the utilized, maximum, and available capacity for incineration of liquids, sludges, solids, and gases in 1986, and maximum and available capacity for 1987, 1988, 1989, and 1990. The analysis assumes that hazardous waste capacity not utilized in 1986, as well as all new hazardous waste capacity from 1987 and beyond, will be available for incineration of hazardous wastes.

Table 3-2 summarizes the commercial capacity of industrial kilns for reusing hazardous wastes as fuel. The table presents the utilized, maximum, and available capacity for combustion of liquids, sludges, and

Table 3-1 Commercial Hazardous Waste Incineration Capacity (Million Gallons/Year)

Physical form of waste	1986			1987		1988		1989-1990	
	Utilized capacity	Maximum capacity	Available capacity	Maximum capacity	Available capacity[a]	Maximum capacity	Available capacity[a]	Maximum capacity	Available capacity[a]
Liquids	63	79	16	100	37	131	68	310	247
Sludges	3	8	5	8	5	14	11	97	94
Solids	17	27	10	27	10	50	33	183	166
Gases	0	1	1	1	1	2	2	2	2
TOTAL	83	115	32	136	53	197	112	592	509

Source: TSDR Survey results as of July 22, 1988.

[a] Projected based on maximum capacity for that year minus utilized capacity for 1986 This considers that capacity not utilized in 1986 and all new capacity (from 1987 and beyond) will be available for incineration of hazardous wastes being land disposed that may be affected by the land disposal restrictions

Table 3-2 Commercial Capacity of Industrial Kilns for "Reuse as Fuel" of Hazardous Waste (Million Gallons/Year)

Physical form of waste	1986			1987		1988		1989-1990	
	Utilized capacity	Maximum capacity	Available capacity	Maximum capacity	Available capacity[a]	Maximum capacity	Available capacity[a]	Maximum capacity	Available capacity[a]
Liquids	79	269	190	315	236	286	207	370	291
Sludges	<1	<1	<1	<1	1	2	2	15	15
Solids	<1	1	1	1	1	1	1	1	1
TOTAL	79	270	191	317	238	289	210	386	307

Source TSDR Survey results as of July 22, 1988.

NOTE For cases where capacity was added to existing units or new units were added, all facilities indicated that new capacity would be available 100 percent for hazardous waste

[a] Projected based on maximum capacity for that year minus utilized capacity for 1986. This considers that capacity not utilized in 1986 and all new capacity (from 1987 and beyond) will be available for burning (reuse as fuel) of hazardous wastes being land disposed that may be affected by the land disposal restrictions

solids as fuel in 1986, and maximum and available capacity for 1987, 1988, and 1989-1990. Again, the analysis assumes that hazardous waste capacity not utilized in 1986, and all new hazardous waste capacity from 1987 and beyond, will be available for combustion of hazardous wastes.

(2) Development of the PC data base for other treatment systems. PC data entry sheets were filled out for other treatment systems, and the data were entered into a PC data base. The data base contains data entry fields as well as calculated fields used to perform the capacity analysis. A more detailed explanation of the data fields contained in the data base may be found in a report in the docket for this proposed rule (Ref. 20).

The data base has four major treatment system categories, each of which is divided into subcategories. A more detailed discussion of how and why the categories were developed is given below. The categories and subcategories, along with the codes used to represent them within the data base, are listed as follows:

I. Wastewater Treatment

Process	Code
- Cyanide Oxidation	WW, CO
- Chrome Reduction	WW, CR
- Organics/Metals Treatment	WW, OMT
- Organics/Metals Biological Treatment	WW, OMB
- Sulfide Precipitation	WW, SP
- General Chemical Precipitation	WW, GCP
- Steam Stripping	WW, SS
- Air Stripping	WW, AS
- Biological Treatment	WW, BT
- Carbon Adsorption	WW, CA
- General Oxidation	WW, GO
- Wet Air Oxidation	WW, WAO
- Neutralization	WW, N

II. Solvent Recovery

Process	Code
- Thin Film Evaporation	SR, TF
- Fractionation/Distillation	SR, FD
- Solvent Extraction	SR, SE
- Other Solvent Recovery	SR, O

III. Metals Recovery

Process	Code
- High Temperature Metals Recovery	MR, HT
- Retorting	MR, R
- Secondary Smelting	MR, SS
- Other Metals Recovery	MR, OMR

IV. Solidification

Process	Code
- Solidification	SL, S

The maximum, utilized, and available capacities were totaled for all systems in the data base that fell under each category. Each category is mutually exclusive so that the capacity of a treatment system would not be double-counted. The treatment systems were categorized by using the computer to search each record for key unit types (process codes) that would identify the appropriate category under which the system should be placed. For example, records indicating systems with unit types identified by process codes 2WT, 3WT, 4WT, or 5WT, and 10WT through 15WT were categorized under cyanide oxidation. These categories are used because the BDAT Program has identified them as treatment methods that may be effective in attaining the treatment standards established under the solvents and dioxins, California List, and First Third proposed rulemakings.

(3) Treatment capacity data set results. Only a subset of the treatment systems that compose the treatment capacity data set were required by solvents, California List HOCs, and First Third promulgated wastes. These treatment categories have been identified under the BDAT Program as being effective in attaining the applicable treatment standards. Under each category, only commercial treatment systems were aggregated to establish a national supply of available treatment capacity that may be used to meet the demand created by the Land Disposal Restrictions Rule.

Table 3-3 presents the maximum, utilized, and available capacities of commercial treatment systems (other than combustion) of concern for reporting baseline year 1986 and capacity projections through 1990. The 1986 utilized capacities of these treatment systems were assumed to remain constant for the subsequent years in making these projections. Where a linked system exists, the proportioned system capacity for the linked system is used to avoid overestimating available capacity. For commercial treatment systems that closed between 1986 and 1988 or will close in 1989 or 1990, the utilized capacity of that system remained in the analysis under the assumption that the waste volumes the system was treating will require commercial capacity elsewhere. Keeping the

Table 3-3 Commercial Treatment System Capacities (Million Gallons/Year)[a]

Technology description	Utilized	1986		1987		1988		1989-1990	
		Maximum capacity	Available capacity	Maximum capacity	Available capacity	Maximum capacity	Available capacity	Maximum capacity	Available capacity
Stabilization	118	580	463	589	472	617	499	1,706	1,588
High temperature metals recovery	34	67	34	67	34	67	34	67	34
Cyanide oxidation and chemical precipitation	30	105	75	105	75	189	159	200	171
Chromium reduction and chemical precipitation	177	379	202	379	202	437	260	437	260
Carbon adsorption and chromium reduction/chemical precipitation	4	16	12	16	12	16	12	16	12
Carbon adsorption and chemical precipitation	6	33	28	33	28	42	37	106	101
Chemical precipitation	89	222	133	222	133	222	133	255	166
Sulfide precipitation	64	320	256	319	255	319	255	334	270
Neutralization	18	51	33	51	33	95	77	96	78
Steam stripping	1	12	11	12	11	12	11	12	11
Carbon adsorption	5	7	2	7	2	7	2	19	14
Biological treatment	106	140	35	140	35	157	51	157	51
Wet air oxidation	3	3	<1	<1	<1	5	2	5	2
Secondary smelting	47	56	9	79	32	93	46	95	45
Fractionation/distillation	37	100	63	112	74	109	72	116	78
Solvent extraction	<1	1	1	1	1	1	1	1	1
Thin film evaporation	38	80	42	69	51	95	57	134	96

[a] Numbers may not add exactly because of rounding.

utilized capacity of the closed system in the analysis results in reducing the available commercial capacity for that category. The data in this table was summarized from a report on commercial treatment capacity (Ref. 20).

Table 3-4 is a summary of the 1988 capacity data for all commercial treatment systems of concern for this final rule. The combustion data includes incineration and reuse as fuel in industrial kilns. These data represent the supply (available capacity) for the demand (required capacity) presented earlier.

3.3 Capacity Analysis (Comparison of Required and Available Treatment Capacity)

As previously described, the Agency is responsible for determining whether sufficient capacity exists to meet the requirements of the land disposal restrictions. This involves the comparison of required and available capacity. Available treatment capacity can be obtained from the following sources:

- Onsite (private capacity) - facilities that manage only waste generated onsite.
- Captive capacity - facilities that manage only waste from other facilities under the same ownership.
- Limited commercial capacity - facilities that manage waste from a limited number of facilities not under the same ownership.
- Commercial capacity - facilities that manage waste from any facility.

Table 3-4 Overview. 1988 Capacity for Alternative Treatment/Recovery Technologies[a]

Technology description	Maximum capacity (million gallons/year)	Utilized capacity (million gallons/year)	Available capacity (million gallons/year)
Combustion			
- Liquids	417	142	275
- Sludges	16	3	13
- Solids	51	17	34
Stabilization	617	118	499
Solvent extraction	1	<1	1
Metals recovery			
- High temperature metals recovery (not secondary smelting as identified in the TSDR Survey)	67	34	34
Wastewater treatment			
- Cyanide oxidation, chemical precipitation, and settling/filtration	189	30	159
- Chromium reduction, chemical precipitation, and settling/filtration	437	177	260
- Carbon adsorption and chromium reduction, chemical precipitation, and settling/filtration	16	4	12
- Neutralization	95	18	77
- Steam stripping	12	1	11
- Carbon adsorption	7	5	2
- Biological treatment	157	106	51
- Wet air oxidation	5	3	2
Sludge treatment			
- Acid leaching, chemical oxidation, and dewatering of sludge and sulfide precipitation of effluent	0	0	0

[a] Numbers may not add exactly because of rounding.

Available capacity from these sources is contained in the TSDR Survey data base. The data base contains information from baseline year 1986 and information on planned changes to 1986 management methods and new processes to be installed from 1987 through 1992. The methodology for determining the amount of available treatment capacity was described in Section 3.2.

Required capacity consists of wastes previously land disposed that will require treatment to meet a treatment standard prior to being land disposed. These volumes of waste were identified and underwent treatability analysis as was described in Section 3.1. The result of treatability analysis was the assignment of waste volumes to treatability subgroups.

The comparison of required and available capacity was performed on a facility-by-facility basis. This was done to match treatability subgroups with available capacity of applicable treatment/recovery systems. Available onsite treatment capacity was matched only to volumes that were previously land disposed onsite and were determined to require alternative treatment. If the appropriate treatment/recovery technology was not available onsite, or if adequate available capacity was not present to manage the waste, then the remaining volume of waste requiring alternative treatment was aggregated into a national demand for commercial capacity. The final aggregate of national demand was then compared with the final estimates of national commercial capacity to match treatability subgroups with appropriate treatment technologies. This methodology was used by the Agency to make final determinations concerning variances.

4.0 BIBLIOGRAPHY

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APPENDIX A

Capacity Analysis for Solvent Wastes

APPENDIX A: Capacity Analysis for Solvent Wastes

The tables in this appendix present the results of the analysis of required capacity for each alternative technology on a waste code-by-waste code basis. The tables show the amount of required treatment capacity in 1988 for each solvent waste code. The tables also total the amount of required capacity for each technology.

The original TSDR Survey data were sorted by waste code and type of alternative treatment required to generate these tables. The tables were then combined and summarized to create the technology-specific capacity analysis table for solvent wastes contained in Section 2 of this document.

APPENDIX A

Capacity Analysis by Technology per
Waste Group/Code for Solvents

Technology: Combustion of liquids

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
F001	244,621
F002	382,368
F003	216,663
F004	19,765
F005	491,606
	1,355,023

APPENDIX A (continued)

SOLVENTS

Technology Combustion of sludges/solids

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
F001	5,309,039
F002	10,848,053
F003	7,663,155
F004	3,529,976
F005	10,457,802
	37,808,025

APPENDIX A (continued)

SOLVENTS

Technology Solidification/stabilization

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
F001	72,053
F002	1,203,551
F003	1,205,566
F004	62,678
F005	1,214,326
	3,758,174

APPENDIX A (continued)

SOLVENTS

Technology. Wastewater treatment - steam stripping, carbon adsorption, biological treatment, wet air oxidation

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
F001	839,760
F002	278,920
F003	215,065
F005	206,160
	1,539,905

APPENDIX B

Capacity Analysis for California List
Halogenated Organic Compound Wastes

APPENDIX B

The tables in this appendix present the results of the analysis of required capacity for each alternative technology on a waste code-by-waste code basis. The tables show the amount of required treatment capacity for each of the HOC waste codes. The tables also total the amount of required capacity for each technology.

The original TSDR Survey data were sorted by waste code and type of alternative treatment required to generate these tables. The tables were then combined and summarized to create the technology-specific capacity analysis tables for HOC wastes contained in Section 2 of this document.

APPENDIX B

Capacity Analysis by Technology per Waste Group/Code for
Halogenated Organic Compounds (HOC) - First Third (Promulgated)

Technology Combustion of sludges/solids

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
K001	3,301,278
K016	539,040
K019	80,400
K020	9,600
K030	10,560
K085	960
U037	2,664
U077	12,240
	3,956,742

APPENDIX B (continued)

First Third (Promulgated)

Technology Stabilization of incinerator ash

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
K001	333,224
K016	483,504
K019	768
K020	240
U077	768
	818,504

APPENDIX B (continued)

First Third (Promulgated)

Technology Stabilization of scrubber water treatment sludge

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
K001	33,013
K016	5,131
K019	38
K020	12
U077	38
	38,232

APPENDIX B (continued)

First Third (Not Promulgated)

Technology: Combustion of liquids

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
U044	4,320
U226	5,520
U227	3,600
	13,440

APPENDIX B (continued)

First Third (Not Promulgated)

Technology Combustion of sludges/solids

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
K017	68,400
K085	98,640
P004	336
P037	576
P123	1,680
U036	5,376
U037	3,180
U044	4,608
U061	4,080
U071	320
U072	320
U080	3,468
U129	618
U158	250,080
U192	1,440
U208	48
U209	4,800
U210	3,900
U211	848
U226	9,408
U228	3,660
U239	1,680
U240	1,440
U247	336
	469,242

APPENDIX B (continued)

First Third (Not Promulgated)

Technology Wastewater treatment

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
U080	2,654,520
U210	1,700
U227	2,654,520
	5,310,740

APPENDIX B (continued)

First Third (Not Promulgated)

Technology Stabilization of incinerator ash

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
K017	12,528
U158	49,248
	61,776

APPENDIX B (continued)

First Third (Not Promulgated)

Technology: Stabilization of scrubber water treatment sludge

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
K017	626
U158	2,462
	3,088

APPENDIX B (continued)

Not First Third

Technology   Combustion of liquids

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
P024	480
U073	240
U080	960
	1,680

APPENDIX B (continued)

Not First Third

Technology Wastewater treatment

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
D014	1,920,000
K105	4,560
	1,924,560

APPENDIX B (continued)

Not First Third

Technology Combustion of solids

Waste code	Required capacity 1988 Without underground injection wastes (gallons/year)
D012	451,200
D013	437,760
D014	720
D015	720
D016	199,920
P024	3,120
P028	720
U030	240
U071	480
U072	218,880
U076	8,880
U131	144,000
U156	1,440
U240	21,360
U142	240
	1,489,680

Land Disposal Capacity (millions of gallons)

Disposal practice	Number of facilities	1986 utilized capacity	Remaining post 1986 capacity
Commercial			
- landfill			
- land treatment			
- surface impoundment			
- underground injection			
Non-commercial			
- landfill			
- land treatment			
- surface impoundment			
- underground injection			

APPENDIX C

Capacity Analysis for Contaminated Soil Wastes

APPENDIX C

The tables in this appendix present the results of the analysis of required capacity for each alternative technology for contaminated soils. The tables show the amount of required capacity for each technology.

To generate these tables, the original TSDR Survey data were sorted by waste description code (i.e., those described as soils) and by type of alternative treatment required. The tables were then combined and summarized to create the technology-specific capacity analysis tables for contaminated soils contained in Section 2 of this document.

APPENDIX C

Capacity Analysis by Technology per
Waste Group/Code for Contaminated Soil Wastes

Technology   Combustion of soils

	Required capacity 1988
Solvents	25,736,413
First Third proposed	
F006	15,360
K001	1,680,240
K019	4,080
K020	4,080
K022	610,320
K048	1,002,601
K049	7,307,130
K050	12,872
K051	946,413
K052	31,053
K104	84,960
HOCs (First Third not proposed and not First Third)	4,174,281
Total	41,609,803

APPENDIX C (continued)

Technology Stabilization of incinerator ash from the combustion of soils	Required capacity 1988
Solvents	9,736,000
First Third promulgated	
F006	15,206
K001	1,633,438
K022	604,217
K048	992,575
K049	7,234,059
K050	12,743
K051	936,949
K052	30,742
HOCs (First Third not promulgated and not First Third)	0
Total	21,195,929

APPENDIX C (continued)

Technology Stabilization of scrubber water treatment sludge from the combustion of soils

	Required capacity 1988
Solvents	99,689
First Third promulgated	
F006	154
K001	16,802
K022	6,130
K048	10,026
K049	73,071
K050	129
K051	9,464
K052	311
HOCs (First Third not promulgated and not First Third)	0
Total	215,776

APPENDIX C (continued)

Technology Solidification/stabilization of soils

	Required capacity 1988
Solvents	133,200
First Third promulgated	
F006	3,328,320
K061	1,364,160
K062	1,042,560
	5,868,240

APPENDIX C (continued)

Technology: Chromium reduction of soils	Required capacity 1988
First Third promulgated	
K062	235,200

APPENDIX D

Treatability Groups

APPENDIX D

Treatability Groups

TRD Group	Waste Code/A-B Codes
1	K022 A06,A09, K035.A06,A09; K036:A06,A09, K037 A06,A09, K045·A06,A07,A09, K047 A06,A09, K101·A06,A07,A09, K102 A06,A07,A09, K106 A09, F020:A06,A09, F021 A06,A09, F022 A06,A09, F023 A06,A09, F026.A06,A09, F027 A06,A09, F028 A09, F001 A09, F002.A09, F003.A09, F004 A09, F005 A09, F024 A06,A09, K001 A09, K009 A06,A09, K010·A06,A09, K015 A06,A09, K016.A06,A09; K017 A06,A09, K018 A06,A09, K019.A06,A09, K020 A06,A09, K021.A09, K028.A09, K029.A06,A09, K030.A06,A09, K032 A06,A09, K033.A06,A09, K034·A06,A09, K041 A06,A09, K042:A06,A09; K043 A06,A09, K073.A06,A09, K085·A06,A09, K095.A06,A09, K096 A06,A09, K097 A06,A09, K098 A06,A09, K099 A06,A09, K105.A06,A09, K116 A06,A09, F007 A09, F008 A09, F009.A09, F011 A09, K005,A09, K007 A09, K011 A06,A09, K013 A06,A09, K014 A06,A09, K060 A06,A09, K023·A06,A09, K024 A06,A09, K048 A09, K049 A09, K050 A09, K051 A09, K052 A09, K103.A09, K104 A09, D012.B36, D013 B36, D014·B36; D015:B36; D016 B36, D017:B36, U072.AEB, U036 A06, U066 A06; U080·A06, U226·A06; (D015,P123·B36), (F002,F005:B36), (F001,F003,F005 B36), (P044,P050,P071,P089.B36), (U220,U159.B36), (U226,U080,P054,F002:B36); (U240,P094:B36); U051.A06, U073;A06; U122:A06; (D016,D017·B36); (F003,F005:B36); (F003,F005,U019,U154:B36); U051:A06; U122:A06(S); U188:A06(S), U223.A06(S); U226.A06(S); U228.A06(S), (D001,F002:B36), (D001,F001,F002,F003,B005:B36); (D001,F002:B36); (D001,F002,F003,F005 B36); (D001,F002,F005 B36); (F001,F002,F003:B36), (F001,F002,F003,F004,F005:B36), (F002,F003:B36); (F002,F003,F005:B36); (F002,F005:B36), (F002,U019,U037,U070,U071,U072:B36); U009:A06; (F001,F002,F003,F005·B36); (K011,K013·B36); P063·A06; U108·A06(S), (F002·A06(S)); K001 A06(S); U036·A06; (F001,F002,F003,F004,F005.A09), U223.A06(S), U037.A06(S), U061 A06(S); U077 A06(S), K001.A06, K035 A06, P020.A06, P050 A06; P071.A06, U188·A06, (P020,P050,P071,P120,P037·B36), (D001,D002,U019,U211,U188 B36), (U051,K001·B36); (D001,D002,U037,U077,U067:B36), (D001,D002,F002,U226.B41), (U105,U106:B36); (U002,U154,U159,U161,U239.B36), (U147,U182,U219:B85), (U188,U122·AEI); P037·A08; P081.A09, U208:A06; P063:A06, F001·A06; F002:A06; F003:A06; F004 A06; F005.A06, U031.A06, U072:A06, U154.A06, P094 A06; U080.A06; U069.A06; U188 A06; U210:A06; P089:A06(S); (F001,F002,F003,F005·B43); (F002,F003,F005,U019·B36); (F002,F003,U012,P030,P004,P064 B42), (F002 B82, F003:B42, F005:B42); (F024,K019,K020,U077:B36); (K022,U188,U055:B36), (P123,U061:B36); (U022·B45; U080,U226:B36); (K104:A06); (U031,U220,U239:B36), (U003:A06), (U188,U052·B52); (U051,U165·B36)(U081,U188 B36)(U083,U140,U226·B36), U221 A06, U239 A06, U248 A06

APPENDIX D (Continued)

TRD Group	Waste Code/A-B Codes
2	D012 B80,B81,B86,B89, D013.B80,B81,B86,B89, D014.B80,B81,B86,B89, D015 B80,B81,B86,B89, D016:B80,B81,B86,B89, D017·B80,B81,B86,B89; K034 A07, K043,K118 A07, U067 A06, U240,K061 A08, (P063 BID,BXA,U009.BID,BXA,K011 BID,K013 BID), (F001,F002,F004,F005.B89), U122:A07(S), (U019,U165,U220 B90), (U051,U052 B90), U072 A08(S), (U122,U159,U188,U220 B90), (U220,U226:B90); D001,D002,D003 B64, U188,U223,U051 A08, U221 A07(S), (F003,F005,P063.B11(S)); U069 A08, U080 A08, U158.A13; U188 A08,A09,A13, U210 A08, U228:A13, U188,U223,U051 A08, D012.B80, D016:B80, (P071,P123,U239 B81), U061 A08, (F002,F002·B84, F003,F004,F005·B90), (F002:B89,F004·B90), (K022,K083,U012,U055,U188 B45), U210.A08, U211.A08, U220 A08, (D001,F003,F004 B89) (D001,D002 B82) (D001,D002,D003:B82) (D002,F003,F005 B89) (D001,D014 B80) (D001,F003:B89) (D001,U122 B89) (D002,P089·B90) (D001,F003,F005 B89) (D002,F001,F005 B89), (U240,U192 B81) (F003,F004,F005.B89) (F004,D001 B89) (D001,F002,F003,F005 B89) (K001,U051:B89) (D001,D014,U240,U093 B80) (K022,K083.B90) (U012,U221·B90) (D014,U036,U093,P020·B80) (U070,U071,U072:B89) (U159,U220·B90) (D001,F001,F002,F003,F004 B89) (U180,U170,U226 B90) (U211,U044,U080.B89) (U213,U159.B90) (U220,U209:B89) (U239,U220·B90), (F001,F002,F003,F005.B89) (F001,F002,F003,F004,F005:B89) (F001,F002,F003,F005,D001·B89) (F002,F005,U165,U239,U107:B90) (F024,U077,K019,K020:B89) (K022,K083,U012,U055,U188:B90) (U036,U129,U247,P004,P037:B89) (U044,U080,U208,U211,U226:B89) (U070,U071,U072,U211:B89) (U037,U080,U210,U220,U228:B89) (K022,K085,U012,U055,U188:B90)
3	K009,K017,K029,K042,K095,K096,K116:A07, K014.A05,A07, D001:B69; D002:B59; D012,D013,D014,D015,D016,D017:B64; (D001·B62, D002·B05); (F001,F002,F003,F004,F005:B66); U007·A08; U080:A08; (U188:A08(L)), (U209:A08(L)), (U210.A08(L)), U220:A08(L); U044:RECODE, U074.A13, U012·A08(L), U044.A08(L), U122 A08, U151 A08, U154.A08, U159 A08, U227 A08, (F001,F002,F003,F004·A08), U180.A08, U169·A11, U030 A11, U073·A08, U122·A11, U156 A11
4	F001,F002,F003,F004,F005.A04, (F001,F002,F003 B71)
5	K047.A05,A07, (P071,P059,P050.B14), D003.B64, (D001,D002 B64), (D001,D002:B04), U122.A05

APPENDIX D (Continued)

TRD Group	Waste Code/A-B Codes
6	D004 B66,B68,B73,B74,B77, D005.B66,B68,B73,B74,B77, D006.B66,B68,B73,B74,B77, D007.B66,B68,B73,B74,B77, D008·B66,B68,B73,B74,B77, D009.B66,B68,B73,B74,B77, D010·B66,B68,B73,B74,B77, D011·B66,B68,B73,B74,B77, (D007,P008·B74), (D004,D006,D007,D008·B30), D007 B30, (K027,D007,D008.B75), F019.A04, (D007,D008.B74), (F001,F002,F003,F005,D007 B40), (F003,F005,F006,K048 B40, K049 B), (K086 A04)
7	K010 A07, U154 A08
8	K106·A07, (K106,D009 B51)
9	F001.A01,A02, F002 A01,A02, F004.A01,A02, F005 A01,A02, U070 A08(L), (D001,U054,F001,F003,F005 B58), (U210,F001.B59), (F002,F003,F005·B61), (F002,U226·B59), (D001,D002 B61), (D001,F002,F003,F005·B61), (F003,F005.B61), (D001,F003,F008.B61)
10	F007·A05,A07; F009·A05,A07; F011·A05,A07; F008,F010·A05; D003 B07,B14,B16, D004,D005,D006,D008,D009,D010,D011·B07, (F006.B04,F007·B07,F008:F09), (F007.B07,F008.B09), P063.A08, (D002,F009·B07), (D002,D003,D008,D009:B09), (F002,F003,F005,D007,D008:B38)
11	F008.A07,A08, D003.B24, D004.B24,B25, D005:B24,B25, D006:B24,B25; D008:B24,B25, D009:B24,B25; D010:B24,B25; D011·B24,B25, F008,F009:B24; D007,F006 B24; (F006,F008·B31), (F006:B47; F007:B51) (F006,F008.B47); (F008,F009:B42)
12	D004:B14; D005:B03,B06,B10,B14,B16; D006:B03,B06,B10,B14,B16; D008:B03,B05,B06,B10,B13,B14,B15,B16; D009.B03,B06,B10,B14,B16,B17, D010.B02,B03,B06,B10,B13,B14,B16, D011 B03,B06,B10,B14,B16, K046 A05, (D002,D008,D009·B03), P122 A05, (D009 B05), D008·RECODE; (D002,D008.B14), (D006,D008 B14), (D002,D005,D006,D008:B03); (D002,D004·B03), (D006,D008 B03), (D002,D004,D006.B03), (D006,D008,D010.B14)
13	D005 B23,B31,B32, D006·B23,B31,B32, D010·B23,B31,B32, D011 B23,B31,B32, D009.B23,B31,B32,B34, (D005,D006,D008.B31), D002,D004.B23, P010,P011,P012:A05,A08

APPENDIX D (Continued)

TRD Group	Waste Code/A-B Codes
14	D007 B03,B06,B10,B13,B14,B16, (D002,D007 B03), D002 B03,B10, D007.BAC, (D006,D007,F007,F009:B05), (D002,D007,D008,D009 B03); (K048 B01,K049.B02), (D002,D007,D009 B05), (D002,D007 B05), (D002 B05, D007 B13, F019·B03, F001·B01); (D007·B13, F019 B03); (D002 B05, D007 B06), (D005,D007,D008,D011·B02), (D002,D007,D008 B06), (D002,D006,D007,D008,F007,F009 B05), F006.A06, (P011,U032 B14), (D002,D005,D006,D007,D008·B13); (D002,D006,D007,D008·B03); (D002,D003,D007·B09), (D002,D003,D006,D008·B03), (D002,D004,D006,D007,D009 B14), (D002,D007,D010.B14), (D002.B05, D007.B06), K051 A05
15	D007 B23,B31,B32,B35, K062 AEA, (D004,D005,D006,D007,D008,D009,D010,D011 B23), (K069 A06), (K062 A06), (D004,D006,D007,D008,D010 B20)
16	D003 B08, P030·A05, (D002,D003 B09)
17	D003 B75, P030 A06,A07,A08
18	D004·B20,B22, D005·B20,B22; D006·B20,B22, D007 B20,B22,B30, D008·BEA, D009.B20,B22; D010.B20,B22, D011·B20,B22, F006.A06,A07,A10,A11,A05S,AAB, F019 A06,A07,A10; K002:A06,A07,A10,B20; K003:A06,A07,A10,B20, K004.A06,A07,A10; K005·A06,A07,A10,B20; K006·A06,A07,A10,B20; K007:A06,A07,A10,B20, K008:A06,A07,A10, K044 A07,A10, K046:A06,A07,A10; K048.A10; K049:A10, K050:A10; K051:A10; K052·A10; K062 A06,A10,AAB, (F019,D007 B22), U032.A06, (K061,K062·BID),(D007,D008,K061,F006·BID); D002,D008·B19; (D002,D008:B20); F006:BAB; XASH:B39, K061:A10; (K061,D008:B37); (D008:B36); (K044:A07); (D002,D004,D010:B20); (F006,D007,D008:B37); P012,P110:A06; P015.AAF; P120:A06; (D005,D006,D007,F006.B41); (F006,F019 B41); (D008,F006·B51), (K044,K046.B41), (F005,D008 B38), (F006,D005,D006,D007·B51), (K031,D006 B37), (P015 A08), (U144.A08)
19	K097:A05,A07, K098·A05,A07; K099·A05,A07; K073·A05,A07(L), K033.A05,A07, D012.B02,B16, D013.B02,B16, D014 B01,B02,B16, D015:B02,B16, D016 B02,B16, D017.B02,B16

APPENDIX D (Continued)

TRD Group	Waste Code/A-B Codes
20	K028 A06,A07, K044,K049,K050,K051,K052 A06, (D007,D008,F002,F003,F005:B82), (D008,F003,F005.B36), (D008,F003·B36), (D001,D002,D003,D004, D005,D006,D007,D008,D009,D010,F003,F004,F006,F019 B56), (D001,D002,D003,D004,D005,D006,D007,D008,D009,F001,F002,F003, F004,F005,F006,K061,K062 BIK), (D001,D002,D003,D004,D005, D006,D007,D008,D009,F001,F002,F006 B36), (D001,D002,D003, D004,D005,D006,D007,D008,D010,D011,F001,F002,F006 B36); (D001,D006,F002,F003,F005·B36); (D001,D006,D007,D008,F001,F002, F003,F004,F006.BIK), (D001,D007,D008,F002.B36), (D001,D008,F002,F003 B36); (D001,D008,F002,F005 B36), (D001,F006:B36), D002,F006,F007,F009,K062·BIK), (D002,D003,D004,D005,D006,D007,D008,D010,D011,F001,F003,F006, F007,F008,F009 BIK), K048 A06(S), P120 A13(S), (D004,D008,D009,U061 B36), K051 A11(S), (D007,F002 B82), (D007,F005:B82), (F001,F002,F003,F004,F005 B89, D004,D005,D006,D007,D008,D009,D010,D011,D012,D013,D014,D015, D016,D017·B40, K086 B90, F006,F007,F008,F009,F010,F011,F012 B40), (F005,F006,D007 B36), (U188,U158·B42; D006,D007,D008:B43); (D008,U221·B90) (D001,F003,F008 B89) (D002,F008.B89) (F003,D008 B89) (F003,D009.B89), (D005,D006,D008,U028,U190.B90) (F003,F004,D008:B89) (K016,K031,F006,U101,U188·B90) (F006,K016,K031:B47) (F003,F019:B51) (K011,K013,F008:B90) (K027,D007:B90) (D004,K016,K031,U188·B52)
21	K105:A05,A07, U185:A05;
22	F010:A07
23	K111:A05,A07
24	(K016,K037.A07); (U061,U142:A08)
25	K018.A07, P039.A08
26	K019:A07, K020 A07, K030 A07

APPENDIX D (Continued)

TRD Group	Waste Code/A-B Codes
27	K048.A07,A11, K049.A07, K050 A07, K051.A07, K052 A07, K086·A07(M), (K048,K049,K051:B73); (K050,K051:B73); (K048,K049,K050,K051·B73); P120·A08; (K048,K049,K050,K051,K052.B90), (K048,K049,K051.B90), K049 A11, K050.A11, K051.A11, (K048,K049,K050,K051 B73), K049.AAC, K049 AAD, (K048,K051·B73), (K048,K049,K051.BQB), (D003,K051 B26), (D002,K049·B73), (K048,K049,K050,K051,K052 B73), (K049,K051·B62(S)), (K049,K051.B22), (K048,K049.B73), (K049,K051·B90), (K048,K051·B90), (K048,K051:B73)
28	K071 A05,A07, (K071,K106·B52), (K071,K106,D002,D009 B51)
29	K103 A05,A07, K104 A05,A07, (K083,U012 B02)
30	K061 A07,AEA, U151 A08, D008 B20,B22
31	K062.A05,A07, (K062,D002 B03)
32	K015:A07
33	F003:A01,A02
34	K031.A06,A07
35	D002:B04,B05,B14,B35; (K062 B04, D002:B05); D002:BMB,B52, (K062:B04,D002·B05); F006:B04; U134:A05; D009:B30, F005:B20(M)
36	K011.A07; K013.A07, (K011,KQ13,P063,U009:B64), P069.A08, U009:A08; D008:B69; (D002,D003,U012,U037,U015:B64); (U012,U070:B64)
37	F020.A07(M), F021.A07, F022:A07; F023 A07; F026.A07, F027.A07, K073:A07; K060 A07 (sludges)
38	F020.A05,A07(L), F021 A05,A07, F022 A05,A07, F023 A05,A07, F026 A05,A07, F027 A05,A07, K060.A05 (liquids)

APPENDIX D (Continued)

TRD Group	Waste Code/A-B Codes
39	K001,K022,K035,K036,F024,K032,K041,K083,K085,K087 A07, D012·B22,B30,B71,B79, D013·B22,B30,B71,B79; D014·B22,B30,B71,B79; D015·B22,B30,B71,B79, D016.B22,B30,B71,B79, D017 B22,B30,B71,B79, F001 A03, F002.A03, F003.A03,B74, F004·A03,B74, F005 A03,B74, P024,P089,P094,P123 A08, (F003,F005·B77); (K027,D002 B75), (F001 B61, F002.B71, F003 B72, F005.B63, XOIL B63), K083:A07(M); (F001,F002 B71)
40	F001 A05,B01,B05, (U188,U031,U037·B01), F002 A05, F003·A05, F004.A05; F005.A05, P020 A05, U210 A05, U177 A05, U211 A05, U244 A05, (F003,F004,U008:B05), (U159,U041,U077,U083,U084 B01), (F001,U162 B05), (F001,F004,F005 B01); (F001,F002,F003,F004 B01), (F001,F003,F004,F005 B01), (U154,U239,F003,F005 B14), (K019,K030.B02), (U034,U044,U045,U220 B02), (D001,F002,F003,F005 B01), D001 B01
41	K073 A06
42	U031 A05, U154 B05, K016:AEE
43	P005 B06
44	D004 B66,B68,B63; D005:B66,B68,B63; D006·B66,B68,B63; D007·B66,B68,B62,B63; D008·B66,B68,B63; D009:B66,B68,B63, D010 B66,B68,B63, D011.B66,B68,B63; (D001:B62, K086:B66); K086.B66, (P005:B06, D001:B69), K086.A02, (D001,D002,D007:B63); (K048,K050:B62); (K048,K049 A05)
45	(K022,U188,U055,U002,D007:B02); (P056,D007:B14); (D001,D007,F002,F003,F005:B01)
46	(K022,U188,U055,U002·B02); U188:A05
47	U147 A05, U170 A05
48	(K062,D002,F003,F004,U008,U009 B05), (D006,D007,F001 B09)

APPENDIX D (Continued)

TRD Group	Waste Code/A-B Codes
49	K011,K013 A05, U009 A05,B05, (K011,K013 A05), (K011,K013,K014 B02), (K011,K013,K014 B02,D002.B05), (K011,K013,U009,U154,U162,U192,U008,U007,P069,P063,F001 B05), (K011,K013,U009,U192,U008,U007,P069,P063.B05), (K022,K013,P003 B02, P063.B08), (U009·A06(L), (K011,K013,K014 B02, D002·B05), (D002 BAG)
50	K015 A05
51	D004 B06,B03,B10,B16,B18, (D002,D004·B10)
52	D004 B23,B31,B32
53	D004 B07
54	F010,F011 A07, F012,A05
55	K024 A07
56	K045,F001.A10, K062,P120:A11, (F003,F005·B38), (D006,D008,F001,F002,F003,F005,F006,K048,K049,K051 B40),
57	Lab packs
58	(K011,K013,K014:B30); K011:AED
59	(D008,F001.B51)
60	Soil/debris
61	K069.A07
62	F008·A04, (D004,D006,D008·B30); K084 A07(M)
63	None assigned
64	None assigned
65	(D007,D008,D001,K061,F006 B1D); (D007,D008 B82), (D001,D005,D006,D007,D008,D010 B82), (D001,D006,D007 B82), (D008 B82); (D001,D007,K017·B82); (D001,D008:B82), (D001,D009:B32), K049,K050:A06(S); (K051,D008·B90); (D001,F001:B82); (F001,F005:B82)

APPENDIX D (Continued)

TRD Group	Waste Code/A-B Codes
66	(F006,P029,P074,P121 B47), (F007,F008,F010,F011,F012 B10), F007,F008 A06, (F007,F009:B46), (F006,F012,K044,K046 B41), (F006,F012 B41(E)), (P029.A06) (P106 A06)
68	(K048 B01, K049·B02, K051 B21, XWWL B62, XWWS B82)
69	(D004,D008,D009 B26)
70	K049 A05
71	D008 B23,B29,B31,B32
72	None assigned
73	(K022,D001,D002,F001,F002,F003,F004,F005,P012,P018,P022,P056, P075,P098,P105,P106,P119,U001,U002,U004,U005,U006,U008,U012, U019,U031,U037,U044,U045,U052,U055,U056,U066,U069,U070,U071, U072,U077,U092,U101,U107,U112,U113,U115,U117,U118,U120,U122, U123,U133,U134,U140,U144,U151,U154,U159,U161,U165,U167,U188, U190,U196,U201,U209,U211,U219,U220,U226,U239 B01)
73A	(D003,D006,D007,D008,D010.B14)
74	(D007,D008,D009,K049:B73)
75	(D002,D005,D009,D011,D014:B05)
77	(D002,D007·B64); D007·B64
78	K031:A05, D008.B02, D005.B64
79	D007:B02
81	P105.A05
82	K086 A07(L),A05
83	(D001,D002,D003,D004,D005,D006,D007,D008,D009,D010,D011,D012, D013,D014,D015,D016.B70)
84	Mixed RCRA/radioactive wastes
85	K104·AAE

No longer generated: K004, K008, K021, K036, K060, K073, K100, K025

APPENDIX E

Alternative Treatment/Recovery Technology Groups

APPENDIX E

Alternative Treatment/Recovery Technologies (AT/RT) for Each Waste Group

TRD group	AT/RT codes
1	1
2	1,2
3	1b,2b
4	1a,2a,3,4
5	5,21,22
6	7a,41a
7	1b,2b,8
8	9,10
9	4,11,1b,2b
10	12,13,49
11	14,13,50
12	15
13	16,10
14	17
15	18
16	19
17	20
18	10
19	5,21,22,3,4
20	7
21	23,5,21,22,8
22	7,12,13,49
23	5,22,24,25
24	26,1a,2a
25	26,1b,2b
26	26,1a,2a,3,4
27	27,7a,41a
28	28
29	29
30	30,31
31	32,17
32	34,1b,2b
33	1b,2b,3,4,11
34	10,35
35	38
36	1b,2b,5,21,22
37	1a
38	1b
39	1a,2a
40	5,21,22,24,6
41	52
42	6,21,22
43	44

APPENDIX E (continued)

IRD group	AT/RT codes
44	7b,41b
45	36,40
46	5,6,21,22
47	6
48	42,43
49	5,21,22,67
50	34,1b,2b
51	45
52	46
53	47,48
54	39
55	26,1,2
56	51
57	53
58	1a,2a,21,22
59	56,41
60	54
61	55
62	56a,41a
63	56b,41b
64	56c,41c
65	7,41
66	14,50
67	57
68	58
69	62
70	63,64
71	10,16,30,31
72	13
73	59,60
73A	65,66
74	59,60,61
75	48,59
77	7b,36,41b,43
78	13,68
79	36,42,43
81	21,22,70
82	69
83	7a
84	70
85	1,71,21,22

APPENDIX F

Alternative Treatment/Recovery Technologies

APPENDIX F

Alternative Treatment/Recovery Technologies

Alternative Treatment/Recovery Technology Codes	Description
1	Incineration of solids
1a	Incineration of sludges
1b	Incineration of liquids
1c	Incineration of gases
2	Reuse as fuel of solids
2a	Reuse as fuel of sludges
2b	Reuse as fuel of liquids
3	Solvent extraction
4	Fractionation or batch still distillation
5	Carbon adsorption
6	Biological treatment
7	Incineration of solids followed by stabilization of the ash and chromium reduction followed by metals precipitation of scrubber water with stabilization of treatment sludge
7a	Incineration of sludges followed by stabilization of the ash and chromium reduction followed by metals precipitation of scrubber water with stabilization of treatment sludge
7b	Incineration of liquids followed by stabilization of the ash and chromium reduction followed by metals precipitation of scrubber water with stabilization of treatment sludge
8	Solvent extraction followed by steam stripping and carbon adsorption
9	Retorting followed by stabilization of the ash
10	Cement based or pozzolanic stabilization
11	Thin film evaporation
12	Cyanide oxidation followed by chemical precipitation, sludge dewatering, and stabilization of the sludge
13	Wet air oxidation followed by carbon adsorption, chemical precipitation, sludge dewatering, and stabilization of the sludge
14	Slurrying followed by cyanide oxidation, chemical precipitation, sludge dewatering, and stabilization of the sludge

APPENDIX F (continued)

Alternative Treatment/Recovery Technology Codes	Description
15	Chemical precipitation, sludge dewatering, and stabilization of the sludge
16	Slurrying followed by chemical precipitation, sludge dewatering, and stabilization of the sludge
17	Chrome reduction followed by chemical precipitation, sludge dewatering, and stabilization
18	Slurrying followed by chrome reduction, chemical precipitation, sludge dewatering, and stabilization
19	Cyanide oxidation
20	Slurrying followed by cyanide oxidation
21	Wet air oxidation followed by carbon adsorption
22	Wet air oxidation followed by biological treatment
23	Solvent extraction followed by steam stripping
24	Steam or air stripping followed by carbon adsorption
25	Fractionation, batch still distillation, or solvent extraction followed by incineration of the organic stream
26	Rotary kiln or fluidized bed incineration
27	Rotary kiln or fluidized bed incineration of sludges followed by stabilization of the ash and metals precipitation of scrubber water with stabilization of treatment sludge
28	Chlorination followed by vacuum filtration, followed by sulfide precipitation, filtration, and sludge dewatering of the filtrate from the vacuum filter
29	Solvent extraction followed by incineration or reuse as fuel of the extract and steam stripping and carbon adsorption of the wastewater
30	Secondary smelting
31	Secondary smelting followed by stabilization of the slag
32	Chromium reduction followed by chemical precipitation and vacuum filtration
33	Chromium reduction followed by chemical precipitation and sludge dewatering
34	Liquid injection incineration or reuse as fuel

APPENDIX F (continued)

Alternative Treatment/Recovery Technology Codes	Description
35	Incineration followed by dissolving of the ash, sulfide precipitation, sludge dewatering, and stabilization
36	Carbon adsorption followed by chromium reduction, chemical precipitation, sludge dewatering and stabilization
37	Solids blending
38	Neutralization
39	Electrochemical cyanide oxidation followed by alkaline chlorination, chemical precipitation, sludge dewatering, and stabilization
40	Wet air oxidation, followed by carbon adsorption, chromium reduction, chemical precipitation, sludge dewatering, and stabilization
41	Reuse as fuel of solids followed by stabilization of the ash from boilers and process heaters
41a	Reuse as fuel of sludges followed by stabilization of the ash from boilers and process heaters
41b	Reuse as fuel of liquids followed by stabilization of the ash from boilers and process heaters
42	Stripping followed by carbon adsorption, chromium reduction, chemical precipitation, sludge dewatering, and stabilization
43	Wet air oxidation followed by carbon adsorption, chromium reduction, chemical precipitation, sludge dewatering, and stabilization
44	Steam stripping followed by chemical precipitation, sludge dewatering, and stabilization
45	Sulfide precipitation followed by sludge dewatering and stabilization
46	Slurrying followed by sulfide precipitation, sludge dewatering, and stabilization
47	Cyanide oxidation followed by sulfide precipitation, sludge dewatering, and stabilization

APPENDIX F (continued)

Alternative Treatment/Recovery Technology Codes	Description
48	Wet air oxidation, followed by carbon adsorption, sulfide precipitation, sludge dewatering, and stabilization
49	Cyanide oxidation followed by chemical precipitation, sludge dewatering and stabilization
50	Slurrying followed by cyanide oxidation, chemical precipitation, sludge dewatering, and stabilization
51	The waste already meets BDAT treatment standard
53	Lab pack waste
55	Total recycle of K069
56	Incineration of solids followed by stabilization of the ash and chemical precipitation of the scrubber water followed by sludge dewatering and stabilization
56a	Incineration of sludges followed by stabilization of the ash and chemical precipitation of the scrubber water followed by sludge dewatering and stabilization
56b	Incineration of liquids followed by stabilization of the ash and chemical precipitation of the scrubber water followed by sludge dewatering and stabilization
56c	Incineration of gases followed by stabilization of the ash and chemical precipitation of the scrubber water followed by sludge dewatering and stabilization
58	Sludge dewatering followed by incineration of the solids with stabilization of the ash Chromium reduction and chemical precipitation of the scrubber water followed by sludge dewatering and stabilization and oil skimming followed by chromium reduction, chemical precipitation, and sludge dewatering and stabilization, of the liquid effluent from the original dewatering
59	Carbon adsorption followed by sulfide precipitation sludge dewatering and stabilization

APPENDIX F (continued)

Alternative Treatment/Recovery Technology Codes	Description
60	Biological treatment followed by sulfide precipitation, sludge dewatering and stabilization
61	Incineration of liquids followed by stabilization of the ash and chromium reduction, sulfide precipitation of the scrubber water followed by sludge dewatering and stabilization
62	Slurrying followed by general oxidation, sulfide precipitation, sludge dewatering, and stabilization
63	Oil skimming followed by incineration of the sludge with stabilization of the ash Chromium reduction, chemical precipitation of the scrubber water followed by sludge dewatering and stabilization, and chromium reduction followed by chemical precipitation, sludge dewatering, and stabilization of the liquid effluent.
64	Oil skimming followed by chromium reduction, chemical precipitation, sludge dewatering, and stabilization of the liquid effluent Reuse as fuel of the sludges followed by stabilization of the ash from boilers and process heaters
65	Cyanide oxidation followed by chromium reduction, chemical precipitation, sludge dewatering, and stabilization
66	Wet air oxidation followed by chromium reduction, chemical precipitation, sludge dewatering, and stabilization
67	General oxidation with hydrogen peroxide or potassium permanganate
68	Carbon adsorption followed by chemical precipitation sludge dewatering and stabilization
69	Steam stripping followed by chromium reduction, chemical precipitation, sludge dewatering and stabilization
70	Mixed RCRA/radioactive wastes
71	Thermal regeneration of carbon